73®

International Edition

December 1983 $2.50
Issue #279

Amateur Radio's Technical Journal

A Wayne Green Publication

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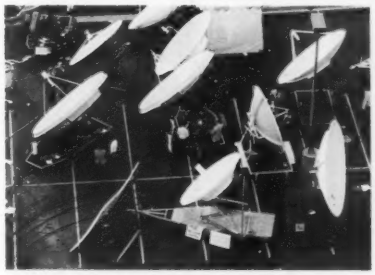

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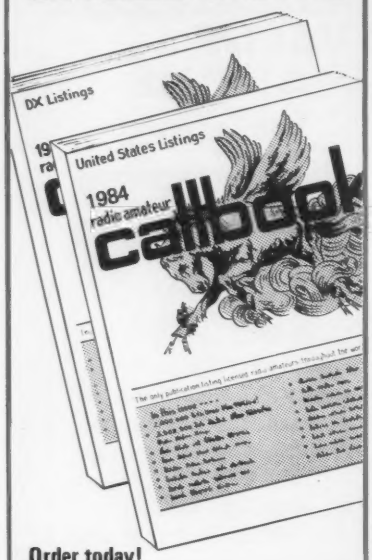

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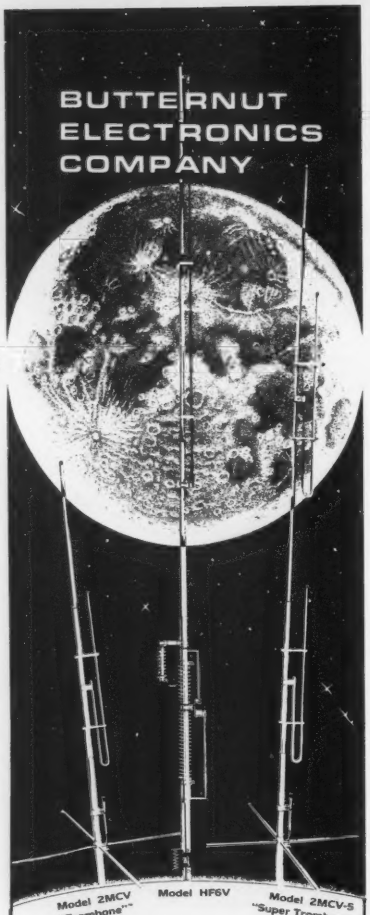

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See List of Advertisers on page 130

W2NSD/1
NEVER SAY DIE
editorial by Wayne Green

ASPEN HAM CONVENTION JANUARY 9-13

Gambling that Aspen will once more manage to coax some snow onto the slopes this winter, you're invited to join the usual intrepid group of hams who will descend on the town during the second week of January. This is the ninth annual ham winter conclave.

Last winter, in addition to the skiing and camaraderie, we had demonstrations and talks on the latest in packet-radio developments. The winter before, there was a symposium on proposed ham-equipment technology developments. It's always something.

At any rate, if you're a ham, a skier, gregarious, and are interested in joining the ham group swarming over the slopes of the four major ski areas in Aspen—and can manage Mexican, Chinese, Eskimo, and other weird foods—you're invited to join us on our round of the restaurants.

I have to get to the Winter Consumer Electronics Show in Las Vegas during the first week in January. This will bring me to Aspen along about Sunday the 8th, during what is called the low season (lower prices). If you bring your HT, you will be able to keep in touch with all of us on the slopes while we're skiing. We might also be able to talk while driving from Denver into Aspen and back—a long drive.

We normally pull between a half dozen and a dozen, plus a fair number of local hams—enough to properly make fun of me when I manage to trip on one of the steeper slopes and crash.

In recent years we've been staying at the Limelight, just a block from downtown. But then almost everything in Aspen is no more than a block from downtown.

Wayne Green haters: Here's your opportunity to rekindle the flames. Wayne Green lovers: Cure that silly fixation once and for all and find out what Wayne Green is really like—if you dare.

FOREIGN GIFT SUBS

The other day I contacted a chap in Czechoslovakia and had a nice chat. It didn't hurt that he recognized my call and commented on how much he has enjoyed *73*. I wondered how, in the face of the currency problems, he had managed to get the magazine. He explained that a kind American ham had sent him copies.

If you have any DX friends, you might think in terms of either passing along your copies of *73* or perhaps buying them a subscription. *73* is of particular interest to DX hams because it has more construction projects than any other ham magazine, it has an international DX news column, and it isn't filled with a bunch of useless operating news or contest results which are of interest to only a tiny minority.

Tell you what, the regular foreign surface subscription rate for *73* is $40 a year. I hate having it that high, but foreign postage rates have gone absolutely crazy and we generally find that it's possible to stay in business longer if we don't lose too much money. But I want to lend a hand to help out our DX friends, so I'll make a deal with you. If you give a DX amateur a subscription to *73* as a Christmas gift and you get the subscription in to me before Christmas, I'll go almost half of the cost. Your price this Christmas for foreign gift sub-

Continued on page 126

QSL OF THE MONTH

Everybody, including hams, seems to be talking to computers these days, and it was only a matter of time before QSLs caught up with the trend. So this month's winner, from Dave Ball WA4PDQ, is a QSL card that would be at home on the wall of the shack or in the supermarket check-out line. Dave neatly included a translation of the bar code for those of us with analog eyes, and if you look closely, you will notice that hidden within the bar code is yet a third translation of his callsign.

To enter your QSL, put it in an envelope with your choice of books from *73*'s Radio Bookshop and mail it to 73, Pine Street, Peterborough NH 03458, Attn: QSL of the Month. Entries not in envelopes or without a book choice will not be considered.

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R-2000 FEATURES:

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- **Optional 118-174 MHz coverage.** Through use of innovative microprocessor technology, frequency, band, and mode data of stations in the 118-174 MHz range may be tuned, displayed (full frequency, ie., 146.000.0), stored in memory, recalled, and scanned, using the R-2000 front panel controls and frequency display, allowing maximum convenience and ease of operation.
  The optional VC-10 VHF converter unit may be easily installed on the rear panel of the R-2000.
- **All mode: USB, LSB, CW, AM, FM.** Provides expanded flexibility in receiving various signal types. Front panel mode selector keys, with LED indicators.
- **Digital VFO's for best stability.** 50-Hz step, switchable to 500-Hz or 5-kHz. F. LOCK switch provided.
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Optional accessories:

- VC-10 118-174 MHz converter.
- HS-4, HS-5, HS-6, HS-7 headphones.
- DCK-1 DC cable kit.
- YG-455C 500-Hz CW filter.
- HC-10 World digital quartz clock.
- AL-2 Surge Shunt

More information on the R-2000 is available from all authorized dealers of Trio-Kenwood Communications
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MFJ-940B, $79.95, 300 watts, SWR/Wattmeter, antenna switch on rear. No balun. 8 x 2 x 6 in. eggshell white with walnut grained sides.
MFJ-945, $79.95, like MFJ-940B with balun, less antenna switch.
MDJ-944, $79.95, like MFJ-940B with balun, antenna switch on front panel, less SWR/Wattmeter.
Optional mobile bracket for 940B, 945, 944, $5.00.

MFJ-900 200 WATT VERSA TUNER

Matches coax, random wires 1.8-30 MHz. Handles up to 200 watts output; efficient airwound inductor gives more watts out. **$49.95** (+$4)

5x2x6 in. **Use any transceiver,** solid state or tube. Operate all bands with one antenna.

OTHER 200 WATT MODELS:
MFJ-901, $59.95, like 900 but includes 4:1 balun for use with balanced lines.
MFJ-16010, $39.95, for random wires only. Great for apartment, motel, camping operation. Tunes 1.8-30 MHz.

MFJ-949B 300 WATT DELUXE VERSA TUNER II

$139.95 (+4) **MFJs best 300 watt Versa Tuner II. Matches everything** from 1.8 - 30 MHz, coax, randoms, balanced lines, up to 300W output, solid state or tubes.

Tunes out SWR on dipoles, vees, long wires, verticals, whips, beams, quads.

Built-in 4:1 balun. 300W, 50-ohm dummy load. SWR meter and 2 range wattmeter (300W and 30W).

6 position antenna switch on front panel, 12 position air-wound inductor; coax connectors, binding posts, black and beige case. 10 x 3 x 7 in.

MFJ-962 1.5 KW VERSA TUNER III

Run up to 1.5 KW PEP **$229.95** (+$10) and match any feedline continuously from 1.8 to 30 MHz; coax, balanced line or random wire. Built-in SWR/Wattmeter has 2000 and 200 watt ranges, forward and reflected power. 2% meter movement. **6 position** antenna switch handles 2 coax lines (direct or through tuner), wire and balanced lines. 4:1 balun 250 pf 6 KV variable capacitors. 12 position inductors. Ceramic rotary switch. All metal black cabinet and panel gives RFI protection, rigid construction and sleek styling. Flip stand tilts tuner for easy viewing. 5 x 14 x 14 inches.

MFJ-989 3 KW ROLLER INDUCTOR VERSA TUNER V

$329.95 (+$10) **Meet "Versa Tuner V". It has all the features you asked for,** including the new smaller size to match new smaller rigs - only 10 3/4"W x 4 1/2"H x 14 7/8"D.

Matches coax, balanced lines, random wires — 1.8 to 30 MHz. 3 KW PEP- the power rating you won't outgrow (250 pf-6KV caps).

Roller inductor with a 3-digit turns counter plus a spinner knob for precise inductance control to get that SWR down to minimum every time.

Built-in 300 watt, 50 ohm dummy load, built-in 4:1 ferrite balun.

Built-in 2% meter reads SWR plus forward and reflected power in 2 ranges (200 and 2000 watts). Meter light requires 12 VDC. Optional AC adapter MFJ-1312 is available for $9.95.

6-position antenna switch (2 coax lines, through tuner or direct, random/balanced line or dummy load). SO-239 connectors, ceramic feed-throughs, binding post grounds.

Deluxe aluminum low-profile cabinet with sub-chassis for RFI protection, black finish, black front panel with raised letters, tilt bail.

↙9 **MFJ-981,** $239.95. 3 KW, 18 position switched dual inductor. SWR/Wattmeter. 4:1 balun.

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MFJ ACCESSORIES

300 WATT ANTENNA TUNER HAS SWR/WATTMETER, ANTENNA SWITCH, BALUN. MATCHES EVERYTHING FROM 1.8 to 30 MHz.

$99.95 MFJ-941D

NEW FEATURES

MFJ's fastest selling tuner packs in plenty of new features!

- **New Styling!** Brushed aluminum front. All metal cabinet.
- **New SWR/Wattmeter!** More accurate. Switch selectable 300/30 watt ranges. Read forward/reflected power.
- **New Antenna Switch!** Front panel mounted. Select 2 coax lines, direct or through tuner, random wire/balanced line or tuner bypass for dummy load.
- **New airwound inductor!** Larger more efficient 12 position airwound inductor gives lower losses and more watts out. Run up to 300 watts RF power output. Matches everything from 1.8 to 30 MHz: dipoles, inverted vee, random wires, verticals, mobile whips, beams, balanced and coax lines. Built-in 4:1 balun for balanced lines. 1000V capacitor spacing. Black. 11x3x7 inches. Works with all solid state or tube rigs. Easy to use, anywhere.

RTTY/ASCII/CW COMPUTER INTERFACE MFJ-1224 $99.95

Send and receive computerized RTTY/ASCII/CW with nearly any personal computer (VIC-20, Apple, TRS-80C, Atari, TI-99, Commodore 64, etc.). Use Kantronics or most other RTTY/CW software. Copies both mark and space, any shift (including 170, 425, 850 Hz) and any speed (5-100 WPM RTTY/CW, 300 baud ASCII). Sharp 8 pole active filter for CW and 170 Hz shift. Sends 170, 850 Hz shift. Normal/Reverse switch eliminates retuning. Automatic noise limiter. Kantronics compatible socket plus exclusive general purpose socket. 8x1¼x6 in. 12-15 VDC or 110 VAC with adapter, MFJ-1312, $9.95.

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Maximize your antenna performance! **$59.95** MFJ-202B

Tells whether to shorten or lengthen antenna for minimum SWR. Measure resonant frequency, radiation resistance and reactance.

New Features: individually calibrated resistance scale, expanded capacitance range (±150 pf). Built-in range extender for measurements beyond scale readings. 1-100 MHz. Comprehensive manual. Use 9 V battery. 2x4x4 in.

INDOOR TUNED ACTIVE ANTENNA

"World Grabber" rivals or exceeds reception of outside long wires! Unique **tuned** Active Antenna minimizes intermod, improves selectivity, reduces noise outside tuned band, even functions as preselector with external antennas. Covers 0.3-30 MHz. Telescoping antenna. Tune, Band, Gain, On-off bypass controls. 6x2x6 in. Uses 9V battery, 9-18 VDC or 110 VAC with adapter, MFJ-1312, $9.95.

$79.95 MFJ-1020

POLICE/FIRE/WEATHER 2 M HANDHELD CONVERTER

Turn your synthesized scanning 2 meter handheld into a hot Police/Fire/Weather band scanner! **$39.95** MFJ-313

144-148 MHz handhelds receive Police/Fire on 154-158 MHz with direct frequency readout. Hear NOAA maritime coastal plus more on 160-164 MHz. Converter mounts between handheld and rubber ducky. Feedthru allows simultaneous scanning of both 2 meters and Police/Fire bands. No missed calls. Crystal controlled. Bypass/Off switch allows transmitting (up to 5 watts). Use AAA battery. 2¼x1½x1½ in. BNC connectors.

MFJ/BENCHER KEYER COMBO

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The best of all CW worlds- a deluxe MFJ Keyer in a compact configuration that fits right on the Bencher iambic paddle! MFJ Keyer - small in size, big in features. Curtis 8044 IC, adjustable weight and tone, front panel volume and speed controls (8-50 WPM). Built-in dot-dash memories. Speaker, sidetone, and push button selection of semi-automatic/tune or automatic modes. Solid state keying. Bencher paddle is fully adjustable; heavy steel base with non-skid feet. Uses 9 V battery or 110 VAC with optional adapter, MFJ-1305, $9.95.

VHF SWR/WATTMETER

MFJ-812 **$29.95**

Low cost VHF SWR/Wattmeter! Read SWR (14 to 170 MHz) and forward/reflected power at 2 meters. Has 30 and 300 watts scales. Also read relative field strength. 4x2x3 in.

1 KW DUMMY LOAD

MFJ-250 **$34.95**

Tune up fast, extend life of finals, reduce QRM! Rated 1KW CW or 2KW PEP for 10 minutes. Half rating for 20 minutes, continuous at 200 W CW, 400 W PEP. VSWR under 1.2 to 30 MHz, 1.5 to 300 MHz. Oil contains no PCB. 50 ohm non-inductive resistor. Safety vent. Carrying handle. 7½x6¾ in.

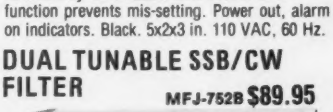
24/12 HOUR CLOCK/ID TIMER

MFJ-103 **$34.95**

Switch to 24 hour GMT or 12 hour format! Battery backup maintains time during power outage. ID timer alerts every 9 minutes after reset. Switchable seconds readout. Elapsed timer. Just start clock from zero and note time of event up to 24 hours. Bright blue .6" digits. Alarm with snooze function. Synchronizable with WWV. Lock function prevents mis-setting. Power out, alarm on indicators. Black. 5x2x3 in. 110 VAC, 60 Hz.

DUAL TUNABLE SSB/CW FILTER

MFJ-752B **$89.95**



Dual filters give unmatched performance! The primary filter lets you peak, notch, low pass or high pass with extra steep skirts. Auxiliary filter gives 70 db notch, 40 Hz peak. Both filters tune from 300 to 3000 Hz with variable bandwidth from 40 Hz to nearly flat. Constant output as bandwidth is varied; linear frequency control. Switchable noise limiter for impulse noise. Simulated stereo sound for CW lets ears and mind reject QRM. Inputs for 2 rigs. Plugs into phone jack. Two watts for speaker. Off bypasses filter. 9-18 VDC or 110 VAC with optional adapter, MFJ-1312, $9.95.

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Code Practice: Have You Seen the Light?

This simple solar cpo is the best weekend project under the sun—or bulb.

You will find this solar code oscillator handy to use whether you are just beginning to practice the Morse code or just keeping in touch. There are no batteries to wear out or to corrode—never fret about shutting the oscillator off. Yes, even years later you can pull the unit off the shelf and it will work every time (Photo A).

In most instances, solar cells are rather expensive to use in small electronic devices. Here, five solar cell pieces are taken from a 10-piece broken energy pack. You can usually purchase this pack for less than $2.00 and practically any size cells can be used for this project. Just connect the five pieces in series and you have a voltage source of over 2 volts.

The unit is assembled in a Radio Shack experimenter box measuring approximately 6 × 3 × 2 inches. Practically all of the components for the solar oscillator, except the solar cells, may be picked up at the local radio store. The LED flasher-oscillator IC can be obtained from any Radio Shack store (276-1705). You can build this solar code oscillator for less than a $10.00 bill, without the telegraph key. In fact, you can assemble it for half that price if a container box and speaker are found in your electronics junk box.

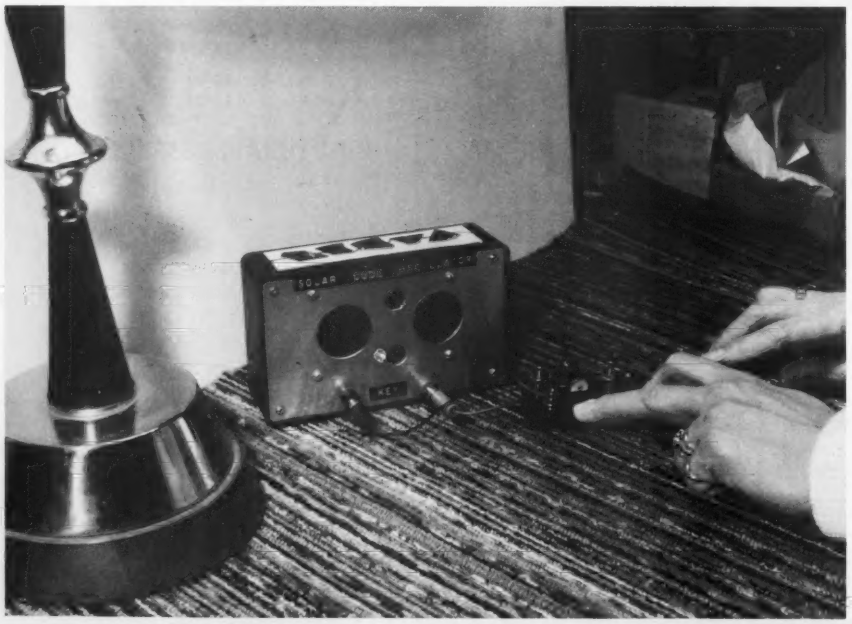

Photo A. This little solar code oscillator may be operated in the sun or under a regular reading lamp. Sufficient volume is obtained from a small 8-Ohm PM speaker.

Since the LM3909 IC oscillator operates on very low voltage (1.5 V) and pulls less than 3 mA of current, solar cell pieces provide adequate power (Fig. 1). The practice oscillator may be operated in the sun or under a reading lamp. Any size 8-Ohm speaker may be used in the project. Just select the correct size and container to house the small PM speaker.

The small components are mounted upon a 2½" × 3" perforated board. Simply cut the small piece from a larger piece of stock. If a smaller size perforated board is handy, use it. There are only five small components to be mounted upon

Photo B. The solar cells may be mounted on the plastic case or on a piece of cardboard. For added protection, cut a piece of thin plastic to cover the cells and cement the ends with rubber silicone cement.

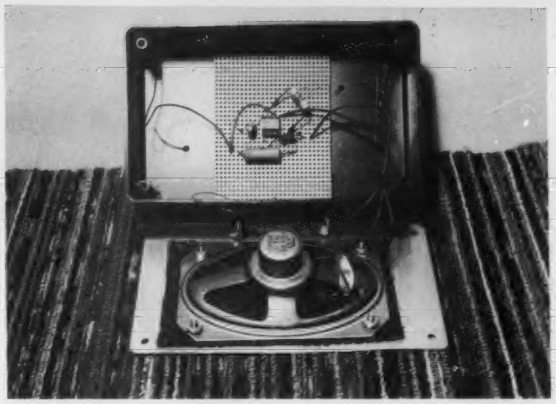

Photo C. The wiring of the small components is mounted upon a small perforated board. After the oscillator is tested, cement the board to the inside of the plastic box.

the perforated board. After all components are wired and tested, the board is glued to the inside of the plastic box with rubber silicone cement.

Mount the speaker on the aluminum cover. Some plastic boxes may have a plastic front cover. Lay the speaker on the cover and mark the speaker mounting holes. Drill several small holes or two large ones for the speaker opening. A piece of metal or plastic screen may serve as grille cloth behind the metal cover. Drill two small holes for the key jacks. Make sure they are insulated from the metal cover.

Connecting the Cells

Select five large pieces from the solar-cell assortment. The solar cells may be mounted directly upon the plastic case or on a piece of cardboard (Fig. 2). Then cement the cardboard cell arrangement to the plastic case. For added protection, you may cover the cells with a thin piece of plastic. Before mounting the solar cells, they should be connected in series.

Start with cell number 1 and connect a six-inch piece of fine wire to the top bar side of the solar cell. Any type of fine hookup or wrapping wire will do. Tin both ends of the hookup wire. Try to solder the cell-connecting wires to the center of each cell. Solder a one-inch lead to the bottom side of cell number 1 (silver). Hold the lead in place with the blade of a pocket knife. Make clean, flowing solder connections.

Now solder the small pieces of wire to the top bar of cell number 2. Flip the cells over and connect another one-inch piece to the bottom side of cell number 2. Connect all five cells in this manner until all cells are wired in series. Solder a six-inch connecting wire to the bottom side of the last cell (5). Under direct sunlight, you should generate from 1.5 to 2.5 volts from the solar cells.

Place a dab of clear rubber silicone cement on the bottom side of each cell. Turn the cells over by holding on to the wire ends. Press the cells in place. Be careful not to press too hard and break a cell. Line the cells up in a row. The cells may be placed close together by curling the small hookup wire. Let the cement set for a couple of hours (Photo B).

Wiring the Circuits

First, mount the IC socket in the middle of the perforated board. Bend over socket terminals 1 and 5. Temporarily, this will hold the socket to the mounting board until all wiring has been completed. The small resistor and capacitor are mounted as they are wired into the circuit. Stick the terminal wires through the perforated holes near the IC terminals. Solder the speaker and solar-cell wires after inserting through the small holes.

Start wiring up the oscillator with the six-inch speaker wires connected to terminal 5 of the IC socket and R1. Solder the long negative wire from the solar cells to the negative terminal of C2. The positive wire of the cells is soldered to the positive

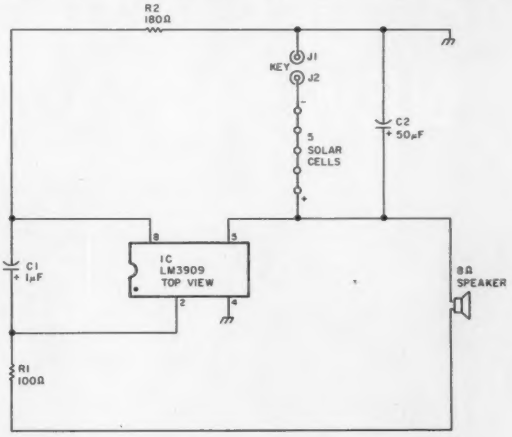

Fig. 1. The oscillator circuit is built around an 8-pin LM3909 IC chip. This small IC pulls less than 3 mA at 2 volts, making an ideal solar project.

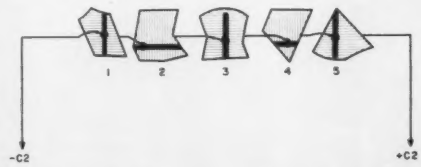

Fig. 2. Select five large solar-cell pieces from the 10-piece assortment. Connect all cells in a series arrangement.

Photo D. Close-up view of the small oscillator. In this model, a metal front panel was used. The speaker holes may be drilled out with a small bit or with a circle cutter.

Parts List

J1, J2—banana jacks (Radio Shack 274-725 or equivalent)
C1—1 uF, 16 V electrolytic capacitor
C2—50 uF, 16 V
R1—100-Ohm resistor, 1/2 W
R2—220-Ohm resistor, 1/2 W
IC—LM3909 (Radio Shack 276-1705 or equivalent)
S1—8-pin IC socket (Radio Shack 276-1995 or equivalent)
Solar cells—10-piece broken energy pack
Crescent solar-cell chips, #P42,749—25 for $10.95 (Edmund Scientific Co., 101 East Gloucester Pile, Banington NJ 08007)
Solar Cell Experimenter's Assortment, S112—$7.95 (Solar Amp, Inc., PO Box 2788T, Denver CO 80227)
Speaker—any size (2- to 4-inch) PM speaker
Miscellaneous—Cabinet, telegraph key, hookup wire, and hardware

terminal of C2. Connect two four-inch hookup wire leads to the key jacks. Ground the lead from the black female jack. Solder the red jack lead to the negative terminal of C2. Don't forget to ground terminal 4 of the IC socket (Photo C).

Double-check all wiring connections with the circuit diagram. If a VOM is handy, check the voltage and solar-cell polarity leads. The positive terminal of the solar cells must be soldered to the positive terminal of C2 and terminal 5 of the IC socket. Usually, the top bar terminal lead of cell 1 is the negative terminal. Of course, the code oscillator will not perform with the solar-cell polarity reversed. You cannot ruin the IC since the low voltage and current is developed with the solar cells; the IC is not damaged with the wrong polarity.

Mark the terminals of the IC socket with a black felt pen or grease pencil. Plug in the LM3909 IC chip with the small dot at terminal 1. Insert the telegraph key and start to tap away. You may find the tone of the oscillator changing somewhat when placed near or out of the light. If the sunlight is too bright, just cover up one of the cells. ■

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Pocket Size Radio, Perfect for Christmas.

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The TR-720 increases the operating safety of balloons, sailplanes, and ultralights by providing communication with ground crews or ATC. It allows receipt of IFR clearances prior to engine start and is indispensible for search and rescue, forest fire fighting, or law enforcement to coordinate aircraft operations. Sport aircraft, homebuilts, or experimental planes (even those without electrical systems) can now have reliable 720 channel communication. But perhaps the best advantage is the peace of mind that comes from having an emergency back-up transceiver.

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TS-930S

"DX-traordinary"... superior dynamic range, auto. antenna tuner, QSK, dual NB, 2 VFO's, general coverage receiver.

A superlative, high-performance, all solid-state HF transceiver, that covers all Amateur HF bands, and incorporates a 150 kHz to 30 MHz general coverage receiver having an excellent dynamic range.

TS-930S FEATURES:

- 160-10 Meters, with 150 kHz-30 MHz general coverage receiver. Covers all Amateur frequencies, plus WARC, on SSB, CW, FSK, and AM. UP conversion digital PLL circuit.
- Excellent receiver dynamic range. Typical two-tone dynamic range, 100 dB (20 meters, 50-kHz spacing, 500 Hz CW bandwidth).
- All solid-state 28 volt operated final amplifier. Lowest IM distortion. Power input 250 W on SSB/CW/FSK, 80 W on AM. SWR/ Power meter.
- Available with AT-930 automatic antenna tuner built-in, or as an option. Covers 80-10 meters, including WARC bands.
- CW full break-in. CMOS logic IC, plus reed relay. Switchable to semi break-in.
- Dual digital VFO's, 10-Hz steps, includes band information.
- Eight memory channels. Stores frequency and band data. Internal battery memory back-up, est. 1 yr. life. (Battery not Kenwood supplied.)
- Dual mode noise blanker. NB-1, with threshold control, for "pulse" noise. NB-2 for "woodpecker."
- SSB IF slope tuning, allows independent adjustment of the low and/or high frequency slopes of the IF passband.
- CW VBT and pitch control. VBT tunes out interfering signals. CW pitch control shifts IF pass-band and beat frequency. "Narrow-Wide" filter switch.
- Tuneable, peak-type audio filter for CW.
- AC power supply built-in.
- Fluorescent tube digital display (100 Hz resolution, modifiable to 10 Hz) with digitalized sub-scale, in 20-kHz steps.
- RF speech processor.
- One year limited warranty.
- SSB monitor circuit.

Optional Accessories:

- AT-930 Auto. antenna tuner.
- SP-930 External speaker with selectable audio filters.
- YG-455C-1 (500 Hz) or YG-455CN-1 (250 Hz) plug-in CW filters for 455 kHz IF.
- YK-88C-1 (500 Hz) CW plug-in filter for 8.83 MHz IF.
- YK-88A-1 (6 kHz) AM plug-in filter for 8.83 MHz IF.
- SO-1 commercial grade TCXO.
- MC-42S UP/DOWN hand mic.
- MC-60A deluxe desk mic.
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- MC-85 multi-function desk mic.

TS-430S

"Digital DX-terity"... General coverage, Superior dynamic range, 2 VFO's, 8 memories, Scan, Notch, COMPACT!

Combines compact styling with state-of-the-art circuit design and performance.

TS-430S FEATURES:

- 160-10 meters, with 150 kHz-30 MHz general coverage receiver. Covers all Amateur frequencies, plus WARC. UP-conversion digital PLL circuit.
- USB, LSB, CW, AM, and FM (optional) all mode.
- Compact lightweight design. Only 10-5/8 (270) W x 3-3/4 (96) H x 10-7/8 (275) D, inches (mm); only 14.3 lbs. (6.5 kg.).
- Superior receiver dynamic range with Dyna-Mix high sensitivity direct mixing system.
- 10-Hz step dual digital VFO's. Operate independently, include band and mode information. Dial torque adjustable. Step switch for 10-Hz or 100-Hz steps. A=B switch shifts "B" VFO to "A" VFO frequency and mode, or vice versa. VFO LOCK switch. RIT for VFO or memory. UP/DOWN manual scan with optional UP/DOWN microphone.
- Eight memories store frequency, mode, and band data. 8th memory stores RX/TX frequencies independently.
- Lithium battery memory back-up. (Est. 5 yr. life.)
- Memory Scan.
- Programmable automatic band scan width.
- IF shift circuit for minimum QRM.
- Tuneable notch filter, built-in.
- Narrow-wide filter selection on SSB and CW (filter optional).
- Speech processor, built-in.
- All solid state. Input rated 250 W PEP on SSB, 200 W DC on CW, 120 W on FM (optional), 60 W on AM. Operates on 12 VDC or on 120 VAC, or 220/240 VAC with optional PS-430 AC power supply.
- Fluorescent tube digital display indicates frequency to 100 Hz (10 Hz modifiable).
- All-mode squelch circuit, built-in.
- Built-in noise blanker.
- RF attenuator (20 dB).
- VOX circuit, plus semi break-in with side-tone.

Optional accessories:

- PS-430, PS-30 or KPS-21 AC power supplies.
- SP-430 external speaker.
- MB-430 mobile mounting bracket.
- AT-250 automatic antenna tuner, 160-10 m, incl. WARC.
- AT-130 compact antenna tuner, 80-10 m, incl. WARC.
- FM-430 FM unit.
- YK-88C (500 Hz) or YK-88CN (270 Hz) CW filters.
- YK-88SN (1.8 kHz) SSB filter.
- YK-88A (6 kHz) AM filter.
- MC-42S UP/DOWN hand mic.
- MC-55 (8P) mobile mic.
- MC-60A deluxe desk mic.
- MC-80 desk top UP/DOWN mic.
- MC-85 multi-function desk mic.

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Optional FC-10 frequency controller
May be easily connected to the TM-201A or TM-401A. Convenient control keys for frequency UP/DOWN, MHz shift, VFO A/B, and MR (memory recall or change memory channel). A green, easy-to-read, back-lighted LCD display indicates transmit/receive frequencies, memory channel number, ALERT, and SCAN (with blinking MHz decimal). Size: 4.4 (112)W x 1.4 (35)H x 0.9 (22)D, inch(mm). Weight: 3.5 oz. (100 g).

TM-201A/TM-401A

Ultra-compact and lightweight, priority, memory and band scan, 25 watts/TM-201A & 12 watts/TM-401A.

The KENWOOD TM-201A 2- meter and TM-401A 70-cm FM mobile transceivers are the smallest and lightest units available, allowing maximum flexibility in automotive installation.

TM-201A/TM-401A FEATURES:

- **Ultra compact and lightweight** Measures 5.6 (141)W x 1.6 (39.5)H x 7.2 (183)D, inch(mm), weighs 2.8 lbs., (1.25 kg.).
- **25-watt output, with HI/LO power switch** Produces a powerful 25 watts RF output from a surprisingly compact design (TM-201A).
- **Dual digital VFO's built-in**
- **5 memories plus "COM" channel, with lithium battery back-up (est. 5 yr. life)**
- **Memory scan/programmable band scan**
- **Priority alert scan**
- **Highly visible yellow LED frequency display**
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- **External high quality speaker supplied** (No internal speaker)
- **16-key autopatch UP/DOWN microphone**
- **Repeater offset switch (±600-kHz/TM-201A; ±5 MHz/TM-401A; and simplex) and reverse switch**
- **Audible "BEEPER" confirms operation**
- **Easy-to-install mobile mount**

TM-201A/TM-401A accessories:

- **TU-3** programmable two-frequency CTCSS encoder
- **KPS-7A** fixed station power supply

TW-4000A

FM "Dual-Bander"... 2-m & 70-cm in single compact package, LCD, 25 W, optional voice synthesizer.

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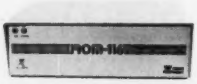

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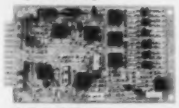

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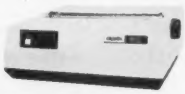

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Sometime between opening that first "guaranteed-easy-to-assemble-in-one-hour" kit and building your own home radar defense system, you're going to have to build a power supply. There's no getting around it—most transistors hate house current, and 800 volts from D-cells is a little impractical. Fortunately, power-supply design doesn't have to be complicated. Granted, there are many, many ways of getting from 117 V ac to something usable, and some of 'em take a Nobel nominee to understand. But if you're not looking for the *most* efficient, 10¢/Watt, state-of-the-art, 10-kW supply in a shoebox, power-supply design can be fairly simple. It won't be elegant, but it'll work. And work pretty well, too.

Any ac-to-dc supply performs two basic functions: rectification and regulation. Simply put, this means changing the ac supplied by the line to dc and maintaining the output voltage (or current) at the desired level. Some designs, of course, are going to do these jobs better than others; they may add other features, such as multiple outputs, current limiting, etc. We'll cover some of these in this article, but what I really want to cover are some basic ideas and rules for a simple power-supply design. By the time you've finished reading, you'll have designed a usable supply for your bench. Well, OK . . . you can finish the rest of the magazine first.

First, a few generic rules for successful designs. Machinists have an old established rule: Spend five hours measuring and five minutes cutting. The same applies to any design. Mistakes on the drawing are easily corrected with an eraser. Mistakes found during construction are often corrected by pitching the whole thing and starting over. **Myers's First Rule for Successful Projects: Get it right on paper first.** Also, let's not forget that we really want to design for the worst case always. For example, what is the most current we'll ever need from our supply at a given voltage? How many outputs are we going to need now and in the future? Once you've determined your worst-case numbers, throw in a little belief in Murphy by making them worse. If I'm going to be powering some TTL, say 5 V at 1 A maximum, I might design for, say, 5 volts at 1.5 A. The extra half Amp might cost me a little bit extra, but I'll never regret putting it in. With that out of the way, let's get on with the design. For the sake of discussion, let's go ahead and build the 5-V, 1.5-A supply I just mentioned.

We know we want a solid five volts at half an Amp, and all we've got to work with is the 117 volts ac coming out of that hole in the wall. First, we'll have to get the voltage down to something reasonable and somehow get it into dc. Fortunately, there's a simple way to change ac voltages around at will—the transformer. Following a step-down transformer ("step-down" because we're going from a high voltage to a lower one), we'll need a rectifier to change the ac to dc and filtering and regulation stages to smooth out the dc output and hold it at a constant level.

We'll begin with a look at rectifiers. A rectifier is anything that changes the back-and-forth, both-directions-at-once alternating current coming out of the transformer to a flow in one direction only. Of course, the lowly diode is ideal for this—all it ever does is conduct in one direction only (well, maybe it does a little more than that, but we'll look into diodes in more detail later). Putting a diode in series with an ac source (in this case, the secondary of the transformer) will give us a sort of dc. During half the ac cycle, the diode blocks the current and no power flows. This scheme is shown in Fig. 1 and is called the

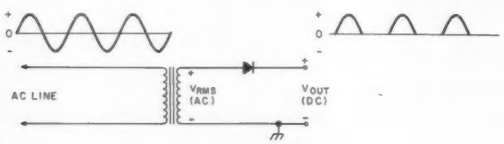

Fig. 1. Half-wave rectifier circuit.

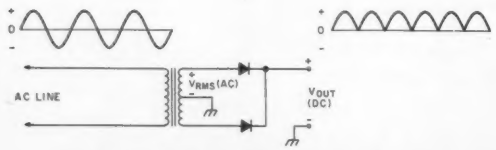

Fig. 2. Full-wave rectifier circuit.

half-wave rectifier circuit, since only half the wave is used. It's cheap and simple, but the half wave not passed by the diode is lost—we can get no power from it. If we were to smooth out the half waves coming out of this circuit, the dc voltage (the average of the half waves) would only be about 0.45 times the rms output voltage of the transformer. This is due to the fact that the output of the half-wave circuit is zero half the time. What we need, it seems, is a rectifier that will let us use the other half of the ac cycle, too.

Fig. 2 shows a full-wave rectifier. The two diodes allow current to flow during the full cycle, with each diode conducting half the time. Now that we're using the full cycle, the average voltage out is 0.9 times the transformer secondary's rms output. (You may have heard rms, or "root-mean-square," voltage described as the "equivalent dc voltage" or, in other words, the dc voltage required to equal the ac in power. So, we're using about everything the transformer could give us.) But notice that the full-wave circuit as shown requires a transformer with a center-tapped secondary. This cuts the ac voltage available in half, since we're only using half the secondary at any instant. This, of course, is going to limit the dc output we can get, and we've got the extra bother of having to find a center-tapped transformer. Hmmmm. What we really need, it seems, is some way to get at that other half of the ac while not needing that third wire. Enter the bridge, shown in all its glory in Fig. 3.

A little thought while looking at this circuit, keeping in mind the fact that diodes conduct in one direction only, will convince you that it works. What we have now are two diodes conducting during each half of the wave, one pushing and the other pulling. And we'll get all the power we can ever hope for.

Diodes being fairly cheap, we'll usually opt for the full-wave bridge as the rectifier of choice. The only time you might want to consider the two-diode full-wave circuit would be for certain high-voltage transformers which simply aren't made for use with any other circuit. These usually have fairly light insulation around the center-tap, which might break down when used with the bridge. Note that this applies only for high-voltage work—for the voltages we've been talking about, it's a pretty safe bet that any transformer will work if it meets our other requirements.

Remember, the average dc output from either full-wave circuit is 0.9 times the rms voltage from the transformer secondary. The maximum dc voltage available would be obtained by putting a capacitor across the output, which would then charge to the peak voltage of the ac, or 1.4 times the rms voltage. This represents the highest voltage that can be obtained from any simple transformer/rectifier circuit. What we can reasonably expect out, then, will fall somewhere between these two values. The next two stages in the power supply will tell us what the output will be and what the transformer output has to be to get there. But first, a bit more on the diodes in the rectifier stage.

Most of the time we'll be using silicon diodes for our rectifiers, and while these are pretty simple parts, there are a couple of things to watch. The first, the diode's current rating, is pretty straightforward. Just make sure the diode is going to be able to handle all of the current you're going to put through it, plus our usual safety margin. For the 1.5-Amp supply we've been talking about, 3-Amp diodes might be a good choice.

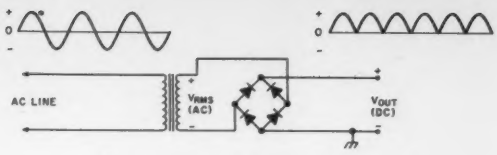

Fig. 3. Bridge rectifier circuit.

The other item we've got to worry about is one that is often overlooked: the peak-inverse-voltage, or piv, rating of the diode. While it's normally assumed that diodes will conduct one way only, you can't push them too far. If the reverse voltage on the diode exceeds the piv rating, the diode may break down and conduct in the wrong direction. Besides being bad as far as the operation of your rectifier is concerned, the large currents going the wrong way can quickly fry the diode.

The inverse voltage you'll have to worry about depends, of course, on the secondary voltage of the transformer and also on the type of rectifier circuit chosen. While the bridge will only put 1.4 times the secondary's rms output across the diodes, the half-wave and the two-diode full wave will put 2.8 times the rms voltage on them. Therefore, if you're running a 10-volt secondary with a half-wave circuit, the diode is going to have to withstand 28 volts placed backwards across it every half cycle. (This assumes that the load is nothing but a capacitor, which is going to charge to the peak voltage as mentioned earlier. But remember, we're always going to design for the worst case.)

With the voltage stepped down to something reasonable by the transformer and converted to dc by the rectifier, all we have to worry about now is smoothing out the bumps left over from the ac and trying to hold the output stable. This can be quite a challenge to the power-supply designer, but there are a few simple techniques we can use to get a usable supply design easily.

Smoothing out the pulsing dc from the rectifier is the job of the filter, which comes right after the rectifier. The simplest arrangement is to use a capacitor or capacitor and inductor combination to remove the ac component remaining in the current. The capacitor, usually a large aluminum electrolytic type, is placed across the output of the rectifier stage. The capacitor looks like a short to the ac component, while blocking the dc.

Another way to look at it is to consider the capacitor as a place to store energy; during the times that the voltage from the rectifier is dropping off, the output is supported by the charge stored in the capacitor.

Either way, the bigger the capacitor and the lighter the load, the higher the output voltage will remain. This situation can be improved somewhat by adding an inductor before the capacitor, in series with one side of the supply as shown in Fig. 4. This is called a choke-input filter stage. Here the inductor acts to block ac while passing dc. We can also look at the inductor as an energy-storage device and say that

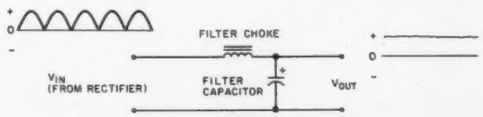

Fig. 4. Choke-input filter.

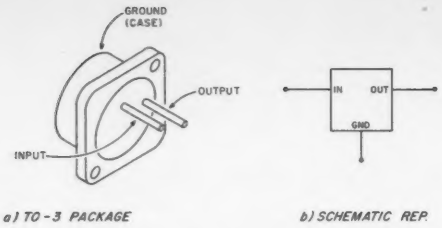

Fig. 5. The LM309 voltage regulator.

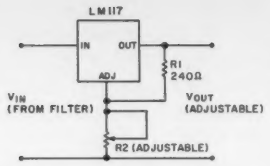

Fig. 7. Variable-voltage supply, with R2 as a potentiometer.

the current is maintained by the inductor (from energy stored in the magnetic field of the coil) during those times when the output of the rectifier is dropping off. Either way, the inductor aids the capacitor in maintaining the output at a constant level.

Capacitor-input and choke-input filtering stages are often all that is needed to provide for an acceptable dc output. But the calculations for proper design of these stages can get somewhat involved, as is finding the proper choke, etc. Fortunately, there are some simple regulating circuits which can make this job much simpler, at least for the supplies we'll want to build. So, we'll just use a large filter capacitor to get rid of most of the ac ripple and let the regulator handle the rest, along with the job of fixing the output voltage.

For light to moderate current requirements, at voltages up to about thirty volts, there is nothing easier than putting a voltage regulator IC in your design. These are integrated circuits which look a lot like power transistors from the outside, but are fairly complicated little pieces of hardware on the inside.

A regulator IC can hold your output voltage stable to within a couple of percent or better, from zero to full load. One of the more popular, the LM309, is shown in Fig. 5. Notice that it has only three leads—the input, the output, and ground. With 7 volts or higher across the input and ground, the voltage from output to ground will be held at 5.05 volts, plus or minus about a quarter of a volt (according to my trusty 1978 *National Semiconductor Linear Handbook*). And, in the TO-3 package (the big, flat can power transistors come in), it's good for a solid 1-Ampere output current. Not bad for a part that'll set you back maybe a couple of bucks at your local parts palace.

While this is almost ideal for our design (it's a little light on current, but there are higher-output versions available—up to 5 Amps and higher in some cases), you should know about the little item shown in Fig. 6. This is the LM117 adjustable regulator. Where the 309 gave us 5 volts out, no questions asked, the 117 allows you to set the output voltage at any point up to a maximum of 37 volts. This is done by connecting two resistors to the ADJ lead, one going to ground and the other to the output. The output voltage is given by:

$V_{out} = 1.25 \times (1 + R2/R1)$.

R1 is usually a few hundred Ohms (the National Semiconductor book suggests 240 Ohms) and R2 is chosen for the desired voltage. Rearranging the above formula, assuming 240 Ohms for R1, gives:

$R2(\text{Ohms}) = (V_{out}/1.25 - 1) \times 240$.

R2 could even be a potentiomenter, as shown in Fig. 7, to make a variable-voltage supply.

Another method of regulating the output voltage of your supply involves the use of a special type of diode called a zener. The zener diode is ideal for use as a voltage reference due to the fact that the voltage across the diode when operated backwards is very constant over a wide range of current. (Actually, all diodes show the phenomenon of reverse breakdown occurring at a certain voltage, but the zener has been so constructed as to fix this voltage precisely at a desired point and to hold to that value better for various reverse currents.) Now, how do we get from the reference level supplied by the zener to a stable output?

Zener diodes do provide a stable voltage drop, but they aren't built to handle large currents. So, the zener won't be handling the output directly. Instead, we'll put the zener at the base of a transistor which is passing the output current, as in Fig. 8. Now, since the transistor is an NPN type, the base and emitter form a P-N diode, just like the silicon diodes used in the rectifier. An interesting property of these diodes is that the voltage drop across the diode, when operated normally (or forward biased), is also fairly stable and fixed at around 0.65 volts. Since we lose 0.65 volts, then, going through the base-emitter diode, the output (the emitter) will be held at a voltage 0.65 volts less than the zener voltage. Now, what are all those other components in Fig. 8 doing there, and how do you design one of these things?

Well, for both the transistor and zener to work, they'll have to have a little current. The zener will require a certain minimum current to do its voltage-fixing trick, and the transistor will need some current into the base proportional to the current passing through from collector to emitter. The dc beta of the transistor is the number of times the current into the base must be multiplied to get the collector current. It can be as high as several hundred for small-signal transistors to as low as five or ten for the big, high-current power types.

As an example, if we're running 2 Amps through a transistor with a beta of 20, the base will need 0.1 Amps. Resistor R1 supplies both the zener current and the base current in Fig. 8. The way to calculate the value for R1 is to subtract the zener voltage from the input voltage to the regulator and divide the result by the total of the zener and base currents. The number you get is the maximum value for R1 in Ohms. As a practical rule, keep the value for R1 well under this number, say 75% of the calculated value. Too large a value for R1 and the transistor and zener won't get enough current to operate properly. Too low and you'll be wasting current in the regulator.

To make the regulator

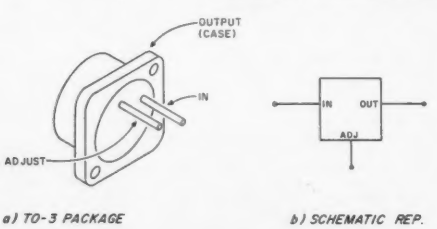

Fig 6. The LM117 adjustable regulator.

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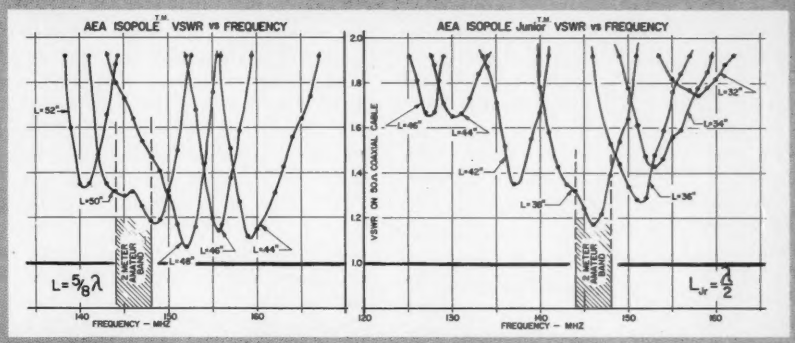

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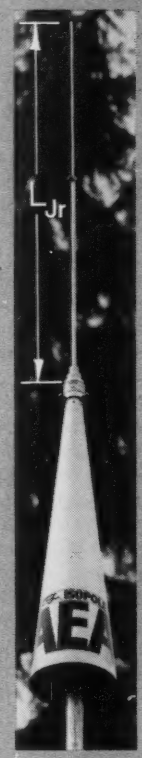

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stage as efficient as possible, we'd like to keep the base current required by the transistor as low as possible since it's wasted as far as the output is concerned. To do this, the beta of the transistor should be as high as possible. However, high-current transistors usually aren't blessed with high betas. One way around this problem is to use a special type of transistor, a Darlington. The Darlington is actually two transistors connected as shown in Fig. 9 (also, the name Darlington more properly refers to the connection of the two transistors and not to the part itself). When combined in this manner, the two transistors look like one, with a combined beta approximately equal to the betas of the two original transistors multiplied together. This can give a part with both high current capacity and high beta, making it ideal for this application. However, the B-E drop is now about 1.3 volts.

The other components shown in Fig. 8 have a place with both the IC and zener/transistor regulators. The small capacitors at the regulator's input and output help keep the output stable when subjected to short, fast disturbances (transients). The diodes across and around the regulator stage serve to protect the active devices against damage.

For example, if the supply is connected to a load which contains, say, a large capacitor, the voltage at the power supply's output may remain high for a short time after the supply has been shut off. In this case, current would try to flow back into the supply, into the regulator's output. The diode from output to input passes this current around the regulator so that it cannot flow into the transistor or IC and damage it. These diodes should be fairly heavy-duty units (at least equal to the rectifier diodes in current rating, and preferably a little bigger).

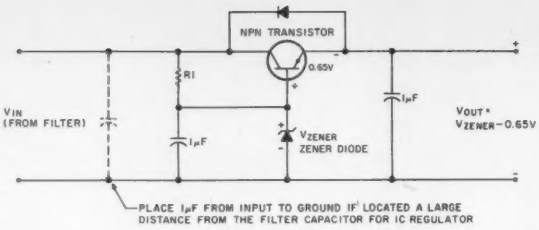

Fig. 8. Zener/transistor regulator.

Of course, sometimes it isn't voltage we want to regulate, but current. The techniques described above, with minor modification, will also work here. Since we've developed a couple of ways to tie down a voltage, regulating current is simply a matter of adding a resistor, as shown in Fig. 10. The regulator stage is now regulating the drop across this resistor, which is in series with the output. But what it's really doing is regulating the output current, thanks to Ohm's Law. The output current is, of course, now fixed at $I_{out} = V_{reg}/R$, where V is the voltage determined by the regulator and R is our series resistor in Ohms. A variable-current supply is made as easily as a variable-voltage one, by using the LM117 with a potentiometer for R2.

No matter how you configure your regulator stage, there are a few things to keep in mind. First, for any of the regulator designs we've looked at, the input to the regulator must be at a higher voltage than the desired output. How much higher depends on the type of regulator chosen, but a good rule of thumb is that you'll need at least two volts more in than you want to get out. Check the manufacturer's data sheet for the exact number in the case of an IC regulator.

Since there is a voltage drop from the input of the regulator stage to the output, this stage is dissipating power. The amount of power dissipated in Watts may be found by multiplying the drop across the regulator by the current passing through it. The maximum dissipation for the device you're using (from the data sheet) must not be exceeded. Most IC regulators will shut down before they pass enough current to cook themselves, but either way your supply won't work. Also, the data sheet for the IC regulators will list a maximum input voltage for the part. Check all the specs before designing in any part.

Well, with all this behind us, let's build a supply. We'll choose a full-wave bridge for our rectifier, which tells us that the output will be somewhere between 0.9 and 1.4 times the rms out of the transformer. Since we wanted a 5-volt supply with a 1.5-Amp maximum output current, let's find a transformer that can give us at least 5/0.9, or about 5.5, volts out at, say, 2 Amps.

But wait—we're going to lose at least two volts in the regulator stage, so what we really need is at least 7.5 Vrms from the transformer. And notice that I said two Amps—not only am I being a little conservative here, but I know that some current is going to be lost in the regulator.

Well, a flip through the latest Radio Shack catalog shows that they've got an 18-V, 2-A center-tapped model available (p/n 273-1515). We could either use half of the secondary (9 Vrms) for this supply, leaving the other half free for, maybe, a second output, or we might use the two-diode full-wave rectifier instead and make use of the center tap.

Looks like we'll switch over to only two diodes for our rectifier, since I really don't need a second output. (Again, one of the advantages of designing before I start building—I can change my mind!) Adding a capacitor after the rectifier will filter the resulting dc sufficiently for the regulator to handle, if we stick to a rule of thumb of about 3,000 uF per Ampere. Since we want 1.5 A out, we'll put at least a 4,500-uF cap here. Since the maximum voltage this cap will see is 1.4 times the rms out of the transformer, this capacitor should be rated for at least 1.4×9, or 12.6, volts. Derating an aluminum electrolytic by at least 25% is always a good idea, so the minimum specs for the filter cap call for a 4,500-uF, 17-V-dc unit. Again, the Radio Shack catalog lists a good choice—their p/n 272-1022 is a 4700-uF, 35-V-dc part which should work just fine.

Moving now to the regulator, we can instantly rule out the LM309 as not having enough current-handling, being rated for only about one Amp. While there are heftier 5-volt regulators available, let's try an adjustable regulator, just for the experience. The LM117 we mentioned earlier is rated at

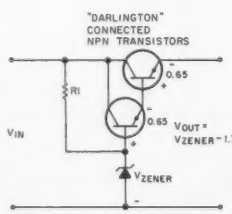

Fig. 9. Darlington configuration.

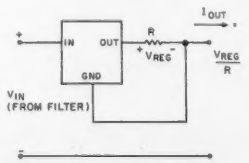

Fig. 10. Regulated-current supply.

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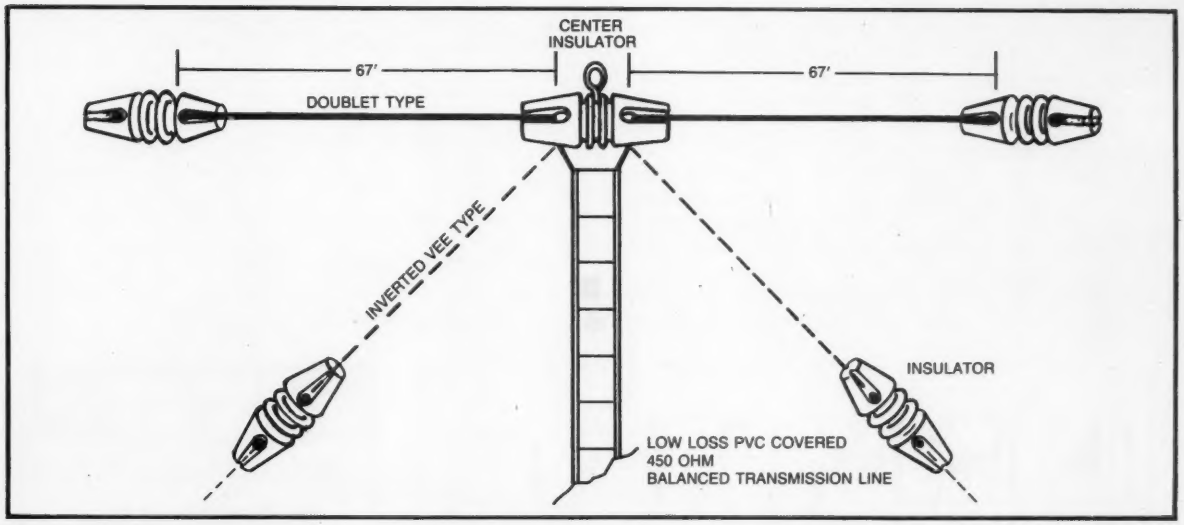

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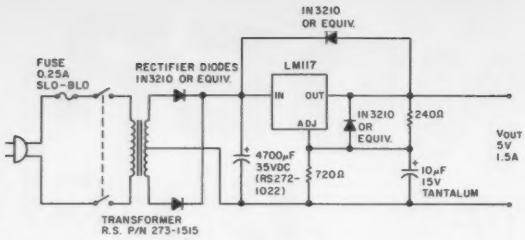

Fig. 11. Final design of the 5-V supply.

1.5 A, or we might play it really conservative and go with a higher-current adjustable such as the LM350. Either way, we can get R2 from our formula, assuming 240 Ohms for R1: $R2 = (5/1.25 - 1) \times 240 = 720$ Ohms. This isn't a standard value, but we can get 720 Ohms by putting a 330-Ohm and a 390-Ohm in series, or hunting through a pile of 680s and 750s with an ohmmeter. Obviously, the closer R1 and R2 are to their design values, the closer the output voltage will be to the desired level.

With R1 and R2 chosen, all that remains is to include the protection diodes and the capacitor at the output (usually about 1 uF) to complete the design of our 5-V supply. The final design is shown in Fig. 11. Notice that a couple of other amenities, such as a switch, a pilot light, and a fuse, have been included in the final schematic. A fuse or circuit breaker is often overlooked in home-brew designs, but you'll never regret putting one in. At the least, you might keep the supply from frying, and you might keep your house wiring from doing the same thing. The proper rating for the fuse is easily determined by remembering that the transformer action with regards to current is the opposite of its effect on voltage. In other words, if the transformer reduces the voltage by a factor of ten, then it'll only draw one-tenth the current into the primary that the secondary is putting out. Since we're going to be drawing at most two Amps from the secondary at nine volts rms, the peak through the primary should be: $I_{primary} = 2A/(117\ V/9\ V) = 154$ mA. A quarter-Amp fuse should make sure that we catch all problems without blowing under normal operation. Use a "slo-blo" type so that the fuse won't blow from the initial inrush of current when you first switch on the supply and the juice zooms into that big filter cap.

Construction should be simple and straightforward, and the layout is as far from critical as you can get. A couple of points, though: Make sure there are no exposed points at line voltage, and be neat with your layout and actual construction. Also, it's a good idea to mount the regulator on some type of heat sink. You could either buy a commercially-made TO-3 heat sink or mount the regulator on the case of the supply (assuming you're using a metal box). In either case, be sure the regulator package is insulated from the case electrically (you can also buy little pre-cut silicone rubber pads, or cut your own), and use a good helping of silicone heat-sink goop.

Have fun designing and building your supplies. If you'd like additional info on power-supply design, either handbook (the ARRL's or Bill Orr's) has an excellent section devoted to the subject. Keep those soldering irons hot! ■

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How many times have you found an excellent construction article in an amateur magazine such as *73* but didn't build the thing because you had no simple, convenient, low-cost method of getting the PCB layout off the page and onto a negative? Magazines and textbooks, unfortunately, have printing on both sides of the page, making it necessary to have the pattern photographed with a copy camera for best results—an expensive undertaking. Other methods such as photocopying leave much to be desired also, due to linear distortion and problems of access to the equipment.

Well, get the junk box fired up, folks, because we're about to walk through a simple, low-cost, and quick method of making PCB negatives that will put you back into the homebrew business. It'll take a lot longer to tell you about it than it will to do it. You don't have to know a thing about photography or have a degree in chemistry to participate, so join in.

Typical article containing PCB layout. My technique offers a simple alternative for those who do not have access to copy cameras or good photocopying equipment.

This technique allows anyone to make exact-size PCB negatives (microwave fans rejoice) directly from the printed page, no matter what is printed on the reverse side (so long as it isn't entirely jet black). The model for this article was taken from a typical page in *73*, as shown in the photograph. We're going to print the whole mess (it may come out with both sides of the page showing) onto Kodalith high-contrast film, then remove what we don't want. The process requires making both positive and negative copies, but have no fear. Only two easily-mixed chemicals are used and the entire operation can be carried out at the kitchen or bathroom sink. The bathroom is better because it's easier to control dust in that area. I'll explain this further on.

First, a word about *positive* and *negative*. The pattern on the magazine page is a *positive* image—the subject, if you will. The *negative*

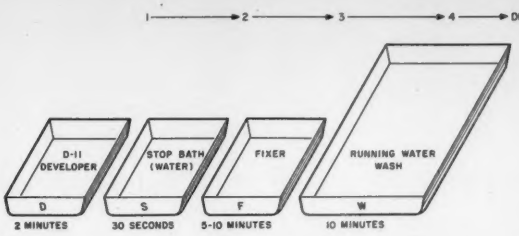


Fig. 1. Layout of trays, showing sequence of operations. Note that trays are marked for their respective chemicals. Interchanging trays and chemicals eventually results in disaster somewhere down the line due to contamination.

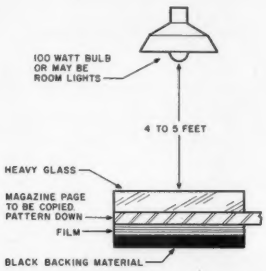

100 WATT BULB OR MAY BE ROOM LIGHTS
4 TO 5 FEET
HEAVY GLASS
MAGAZINE PAGE TO BE COPIED PATTERN DOWN
FILM
BLACK BACKING MATERIAL

Fig. 2. This is the setup for making the first exposure directly from the magazine page.

is the first copy of that subject and is identical to the negative you get in your camera when making an ordinary photograph. By printing that negative, you get an image that looks like the subject; it also is a positive.

The photo-etching process can be done using the positive or the negative technique; we will make both positive and negative images so that all bases will be covered. (See the illustrations.)

Setting Up

First, trot down to the local photography store with the shopping list in Table 1. There are no exotic items on the list, and a well-stocked store should have everything on hand. Graphic arts people and photographers use this stuff by the ton every day.

Next, stop off at the hardware store with the list in Table 2. (All of these items can be purchased at the photo store but would cost you a bundle by comparison.) If you opt to "borrow" some of the common items from the kitchen, keep them. *Don't ever use them for food again. Photographic chemicals are highly toxic.*

Mix the chemicals. Follow the manufacturer's directions. There is no magic involved; just get in the ballpark. A few tips might be in order, however. Mix by stirring, as recommended. Sure, you can dump the whole mess into the gallon jug and shake it like mad, but this action mixes an excessive amount of air with the chemicals and the oxygen in the air causes rapid deterioration of the chemicals.

Try to mix the chemicals the day before you will use them, and store the mixture in the area where you will be developing your film. This will allow any air in the solution to escape—and you won't have to worry about temperature problems. Most schools recommend sixty-eight degrees Fahrenheit as the ideal temperature. This temperature was picked because that was the average room temperature of a house in England when the process was discovered generations ago. Photographic processes work over a wide range of temperatures, with adjustments, but we won't go into that here. Just maintain an average, comfortable household temperature.

Prepare the work area. Dust and dirt are the villains in any photographic process. Clean the work area until it shines. Remember the bathroom recommendation? Great. Turn the shower on hot for a short period of time to fill the room with steam. Turn the shower off, close the door, and let things cool off for about an hour. The steam will have settled all of the dust out of the air by the time you're ready to work.

Minimal equipment is required. The gallon jugs needed are not shown.

The work area must be light tight. The film must be opened and processed only under the illumination of your safelight, so you must seal up the windows and doors so that no great amount of outside light seeps in. I'll leave that operation up to you because how it's done depends on your particular circumstances. To check if it's been done properly, stand in the darkened room for five minutes. You'll then be able to see any obvious light leaks. Seal them up.

Lighting

You will be using two kinds of light; we will call them white light and safelight. The white light can be a 100-Watt light bulb or just the ordinary room lights if they are fairly bright. The white light should be directly over the area where you will be exposing your film. (This area is called the "dry side" of the room.) The safelight that you purchased at the photo store should have a red filter to give off a red-color light. It should have a bulb no larger than 15 Watts, and 7½ Watts is better. Hang it four to five feet away from the film-processing areas. You'll be sur-

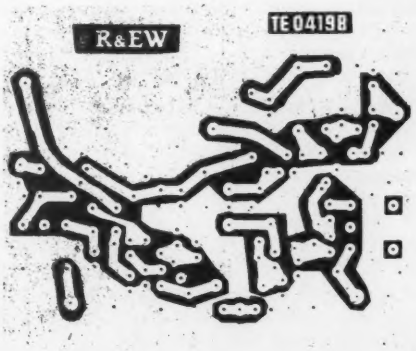
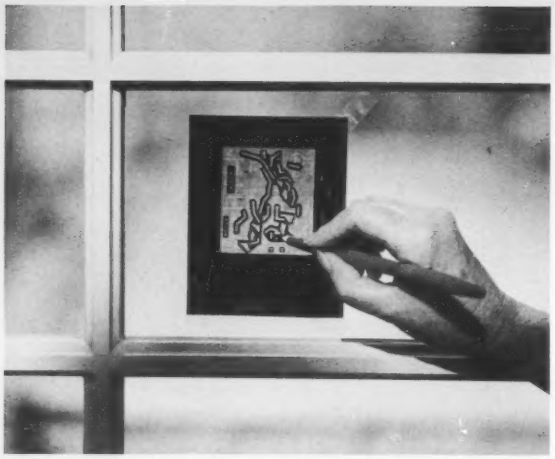


Fig. 3. A negative obtained by the process described.



A windowpane makes a quick "light box" for retouching both negative and positive. Mark on dull (emulsion) side of film only. North light works best.

prised to find that after a few minutes in this dim darkroom light you'll be able to read a newspaper. *Please take all of the usual precautions when working around plumbing fixtures and electricity.* If you are not sure about the safety of your conditions, have an expert check them out. Don't take chances.

Pour about an inch of the appropriate liquids into the three small trays (see Fig. 1) and arrange them as shown. The larger wash tray may be used on the same "wet side" of the room or set up in another area as you will be washing the film in normal room-lighting conditions. If you happen to spill the chemicals, wipe them up because they can cause ugly stains. (Suffering the wrath of others is not part of this process.) Now all of the running is done; the setup is complete, so let's get on with the fun part.

1. Kodalith ortho film, type 3, Kodak #2556. (This is a very thin Graphic Arts film, sold in 4″ × 5″, 5″ × 7″, and 8″ × 10″ sheets, 50 sheets per box. *Do not open except in darkroom.*)

2. Kodak D-11 developer. (Sold in powder form. When mixed with water, makes one gallon. Kodalith developer is usually used with this film but produces overly-hard blacks in unwanted areas for our purposes.)

3. Fixer. (Also known as hypo. Sold under many brand names. May be powder or liquid. Buy powder. In liquid form you're paying for a lot of water.)

4. Photoflo. (Kodak's trade name for a wetting agent that helps dry film without spots. Buy smallest container. It'll last forever.)

5. Stop bath. (A solution of 28% acetic acid and water is normally used but too much acid can produce bubbles on the emulsion. I use plain tap water only, at the same temperature as the other chemicals, for all my films.)

6. Stainless-steel tongs. (One required for handling wet film. More expensive than wood or bamboo but doesn't absorb chemicals and lasts a lifetime.)

7. Safelight with 1a red filter. (I use a 10-Watt red bulb that I know doesn't fog the film. To test: In a dark room, lay a sheet of film on the work table, place a coin on the film and turn on the safelight for five minutes. Develop the film. You should not get an image of the coin on the film if the light is safe.)

8. Red opaque pen. (I use red because it's easy to see on the film. Do not use regular marking pen. Black india ink also works well but can be quite messy.)

Table 1. Photographic materials needed.

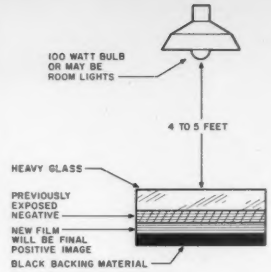


Fig. 4. This is the setup for the second exposure. The resulting positive image can be used to make your PCB.

Making the Negative

Close the door, turn on the red safelight, and turn off the white room lights. Your room should be dimly lighted by only your safelight at this point. Open the film box, snip off the end of the foil envelope containing the sheets of film, and remove one sheet of film. Fold the end of the foil envelope over, place it back in the box and *close the box.* Lay the film on the black backing material—or in the contact frame if you have elected to go that route. The film is so thin that for our purposes it doesn't make any difference which side is up, but it is good darkroom practice *always* to have the emulsion side facing the subject being copied.

Next, place the pattern to be copied on the film, copy down, in contact with the film. Lay the heavy glass on top of the pack to hold everything flat and in place. Fig. 2 shows the setup for this operation. *Recheck the film box to be sure it is closed.* Switch on the white light for two seconds. Turn off the white light. The negative has now been exposed.

Developing the Negative

Remove the exposed negative from the pack and with a quick sliding motion put it into the tray of developer so that it is covered with developer solution. Rock the tray gently by lifting and lowering one corner to keep fresh developer constantly moving over the surface of the film. You will see the image pop up on the film in about thirty seconds. Continue agitating in this manner for a total of two minutes.

When the time is up, carefully grasp the film by one corner with your tongs, lift it out of the developer, and let it drip for five seconds. Slide it into the tray of stop bath and agitate it for about thirty seconds. Again, lift it out by one corner, drain it for five seconds, and slide it into the fixer. Don't let the tongs touch the fixer or the next time you put them in

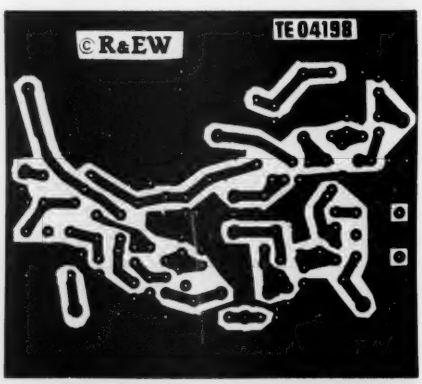


Fig. 5. A positive obtained by the process described.

the developer the fixer will contaminate it and decrease its working life.

Agitate the film in the fixer for five to ten minutes. The film will have a milky-white cast to it when you put it in the fixer. A good rule of thumb is to fix the film for twice as long as it takes for the milky cast of the film to clear. After the film has cleared you can turn on the white room lights. (Did you check to be sure your film box was closed?)

Remove the negative, which should show a good strong image at this point, and place it in the wash tray containing running water of approximately the same temperature as the processing solutions. Wash away the residual fixer for about ten minutes. Turn off the water and add several drops of Photoflo™ to the wash water. Move the film around in the Photoflo solution for about thirty seconds.

Remove the negative from the tray and hang it up by one corner to dry. Do not wipe the film. Drying should take about one hour, but if you're in a hurry you can use a hair dryer to accelerate the action. Let the film drip dry for about fifteen minutes before using this technique, and don't get too much heat on the film or nasty things will happen. Gently does it. Just be sure that it is perfectly dry for the next step.

Fig. 3 shows an example of a negative obtained by the process described.

Opaquing the Negative

Place the film negative on a clean window pane (or light box if you have one) and hold it in place with tape on two diagonal corners. A window on the north side without direct sunlight works best. Now you can examine your negative image in all its glory. The image will be reversed from that in the book—the clear areas representing the copper and the black areas representing the areas where the copper will be etched away on the final board.

The is the first stage. You may notice some of the printing from the reverse side of the printed page showing through the clear areas, but don't be concerned. The next operation will remove it.

With your red opaquing pen, color in all those unwanted spotty clear areas showing through the black, being careful *not* to fill in any clear areas that will eventually be copper. (The red ink allows light to show through, but don't worry about it. The film cannot see red light—it will look black to the film.)

Making the Positive

Back to the darkroom: red safelight on, white light off. Take a new piece of film from the box and sandwich it with your negative, as shown in Fig. 4. *Check the film box to be sure it's closed.* Flick on the white light for a two-second exposure. Run the new film through the developer, stop bath, and fixer the same way you did the first time. Wash and dry. You now have the positive that should look pretty close to that pattern you copied from the page. Tape it to your window or use your light box and spot-fill the unwanted clear areas.

A couple of notes that might help you through the learning curve: Don't be afraid to vary the times given for exposure or processing. Kodalith is a very versatile material that can perform all kinds of tricks for you. For instance, by varying the exposure times you will find that the width of lines and diameters of circles change. Not only is this phenomenon a characteristic of the film and a good indicator of proper exposure, but it can be used to make such things as QSL cards using the line-positive technique. The *Photographic Lab Handbook*, by John S. Carroll, is an excellent reference for this type of work. Eastman Kodak also has a library of publications on the use of their products, most of which should be available from your photo dealer.

The red opaquing pens recommended here are sometimes hard to come by. Black india ink is a good substitute but can be hard to see on the black image. Standard marking pens do not work too well, in my experience. The ink seems to vary widely in its light-filtering characteristics.

Thanks to my wife, Rita, for helping me with this article. ■

1. 3 one-gallon jugs. (Used for mixing and storing chemicals. Must be glass or plastic, not metal. Opaque containers are recommended but are expensive. Empty plastic milk bottles work fine if you store the chemicals in a dark place.)

2. 3 glass, plastic, or stainless-steel trays. (Should be about two inches deep and larger than the largest size film you expect to use. Mark them D, S, and F. Use them for the same chemicals each time.)

3. 1 piece of clear glass, ¼-inch thick. (Should be larger than the largest size film you expect to use. Contact printing frame may be used instead.)

4. Black backing material. (Should be larger than the largest size film you expect to use. I use a sheet of black plastic foam. Material such as cloth will produce lint that will give you fits. Not required if you use contact printing frame.)

5. 1 large plastic tray or tub. (Used for washing film.)

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When the Lorelei *strayed into Nicaraguan waters, hams came to the rescue. Here, the net results.*

Following is a chronological account of an event of which all amateur radio operators can be proud. This is because, beyond any doubt, it was an instance where the Amateur Radio Service was the only means by which comfort, aid, and reassurance were given to certain people who were involved in emergency circumstances.

To the best of my knowledge, all of the operators involved (whose cooperation and coordination were of critical import) were these: Art HH2A, Fred K2OGS, Bill HR1BL, Bob N6CSV, Brian, a non-amateur, Dan N6IAU, NMI (Coast Guard, Miami), N1CLS/5, YV2CPG, and myself, W9UUC.

I usually tune in my radio to the Maritime Mobile Net on 14.313 as soon as I get home (Elmhurst, Illinois), around 3:30 or 4:00 in the afternoon. This is just what I did on Tuesday, May 17, 1983. After listening for only a short time, I heard a station say he was maritime mobile with emergency traffic.

HR1BL (Tegucigalpa, Honduras), who was net control at the time, asked if anyone had a good copy on the ship. Both K2OGS (Yonkers, NY) and HH2A (Haiti) said they did. Net control asked them to move him off the net frequency. They went to 14.324, and I followed them and told them I also had a good copy on the ship.

The emergency call was from Bob N6CSV, and his signal was coming from within 12 miles of the Pacific coastline of Costa Rica. He advised that the emergency was still in progress.

He stated that he had been sailing with three other American sailing vessels on a pleasure cruise about five days out of Mexico. They all had been heading for Punta Arena, Costa Rica, when a storm came up at night and blew the four of them off course. Soon after the weather cleared and the next day had dawned, he found himself alone at sea—in touch with the others through only one of them, Brian. It was Brian who had the emergency and had contacted N6CSV by VHF maritime radio, channel 16.

At that moment, Brian came on frequency and said he was not a licensed operator, but that he understood (correctly, of course) that in an emergency situation it was legal for him to transmit. HH2A couldn't hear Brian too well, but I could, so he asked me to ascertain the nature of the emergency.

Brian informed me that he was aboard the sailing vessel *Lorelei*. He told me how his and the other two ships had become separated by about 20 miles from N6CSV. At daybreak, the three saw close to them land which they believed might be Nicaragua. Realizing that they were in that nation's waters, they immediately headed westward and stayed on that course for some time.

It was then that the reason for the emergency transmission became clear. I learned that on deck above Brian, unaware of his radio communications, was an armed crewman from a Nicaraguan gunboat. All three ships had been boarded (after Brian had thought they were in international waters), and, at that very moment, they were guarded and under orders to sail for the Nicaraguan port of San Juan del Sur.

At this time, HH2A, who could hear enough to get the picture, suggested that this called for US State Department attention. K2OGS agreed and said he would place a call to the departmental emergency number at once.

Still having the best contact with both Brian and N6CSV, I informed them both of our actions. Brian then asked me to call his brother in the States and apprise him of the situation, but ask that he not, at this time, let his wife's folks know what was taking place. At this point, YV2CPG (Philadelphia)—I believe that was his call—came in to say that he was portable in the area and would stand by in case he was needed.

Brian and I were keeping our transmissions as short and infrequent as possible to minimize the chances of having any Nicaraguans overhear, but now Brian informed me that the crisis was deepening. He had just been informed on VHF by the skipper that the order had been given that all men would have to leave the ships when they reached land and that all the women would have to remain on board.

About this time, K2OGS came back on and said Coast Guard, Washington, was going to handle everything and would be up on frequency soon.

For a long time nothing was heard and tension began to mount. N1CLS portable 5 came on and said he was at Keesler Field, Biloxi, and had a direct line to New Orleans if needed.

Finally, after more delay, K2OGS came back to say that NMI (Coast Guard, Miami) was now going to handle everything and would be up on frequency soon.

After what seemed a half hour or longer but actually was only about another ten minutes, NMI did come up on frequency. But could we

turn all transmissions over and just listen? No. NMI had such a terrible ac hum on his signal that he was very difficult to copy and was impossible for Brian. I had to continue to relay all transmissions.

NMI needed specific information, and I obtained it from Brian: the names of all ships and their documentation numbers, the home port for each, a contact phone number in the States for each ship, and the names of all persons on each ship.

NMI also wanted to know if all parties were American citizens, if all three ships had been boarded simultaneously, and where they were heading. I reported for Brian that the answer was yes, they were all American citizens, and that they were being taken to the port of San Juan del Sur. Then NMI wanted to know if they were under any kind of harassment or were being taken in forcibly.

Looking back to that Tuesday, May 17, I believe now that it was at this point that tension had been at its highest, for Brian's answer gave us our first reason to begin to feel better. No, no actual harassment, Brian said, even though there were the armed guards on all ships. In spite of this, said Brian, all three ships were keeping in continuous contact with each other via their VHF marine radios, and nobody was being threatened.

At this point, we heard from HR1BL again. He informed us that he was in touch with the American Embassy there in Tegucigalpa. While he was on the phone with them, he wanted to pass on the same information which I had relayed from Brian to NMI. I therefore gave it to him. A short while later, we learned that the embassy in Tegucigalpa was in communication with the embassy in Managua, the Nicaraguan capital.

Tension heightened once more when it was reported by one of the listeners on both the VHF channel and 14.324 that one American on one of the boarded ships had given a real tongue lashing in Spanish to one of the Nicaraguan naval officials regarding their capture and being forced to sail into a Nicaraguan port. Almost at once, however, a follow-up report cleared the air and it seemed that everybody was being very cooperative.

It is an indication that understandings were then finally being reached by all concerned, that the last transmission I logged—at 2315Z—was to the effect that at least six ships in the Bay of Coco (off Costa Rica—where N6CSV had sent out his call for help) had been listening to all that was said and reported that there was plenty of beer on ice ready for all ships returning from the high seas!

Now we come to the aftermath of the story. At approximately 0110Z on May 19 (2010 Chicago time, on the 18th), I contacted Dan N6IAU on board one of the ships which had been seized. He seemed to know me by name and asked me to make some phone patches for him.

We had a very good ragchew about the whole episode, and from it and the phone patch I made for him to his mother, I learned more about what had then happened.

It turned out that as a licensed amateur operator he had been listening to everything which transpired between me and Brian. I never asked him the reason he didn't ever transmit, but who knows, perhaps he felt the armed guards on his ship might come down at any time.

He felt that one reason they were released so quickly from San Juan del Sur was that the Nicaraguans didn't want the counterrevolutionaries in their country to get hold of the situation and perhaps blow it up all out of proportion. He also stressed how very well they all were treated.

N6IAU even mentioned the fact that they had shown the gunboat guards the weapons they had on board their ships for purposes of self-protection. The guards hadn't been at all interested and made no move to confiscate them.

Not only were they not harassed, but while at San Juan del Sur, the Minister of Defense invited his father to go to Managua for a tour! The Minister took his father around the city and bought him a steak dinner and some drinks. N6IAU said they all had been a little anxious while his father was gone, but when he returned were pleased by the report that the steak was one of the best ever served anywhere in the world!

Finally, you readers should know that N6IAU's mother said that while the State Department had kept in close contact with her and had continually assured her that they would let her know as soon as they had fresh information, thanks to amateur radio, she was able to call the State Department and be the one to report the up-to-date news!

In conclusion, I would just like to state that much of the credit for the successful outcome of this episode should go to Fred K2OGS for contacting Washington and apprising them of the situation and to Bill HR1BL for quickly reporting the details needed to our embassy in Honduras. All I did was relay information to NMI and to HR1BL when he had our embassy on the line. HH2A also did a fine job as net control.

I would like to thank Jack K4DMK (aka the Swamp Rat)—who does a fantastic job as coordinator of the 14.313 MM net—for information received to help me in the preparation of this article. ■

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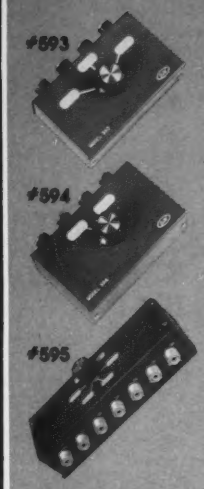

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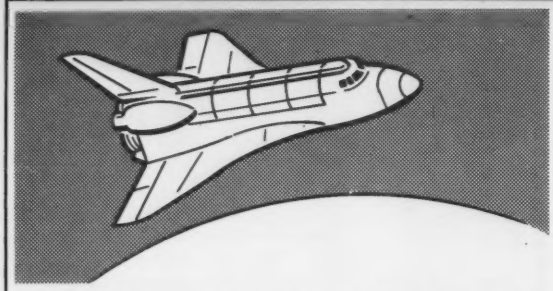

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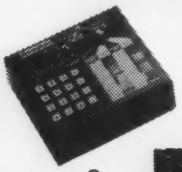

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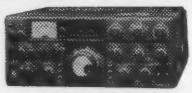

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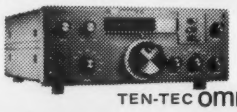

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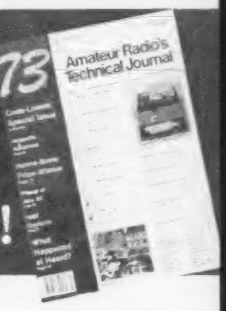

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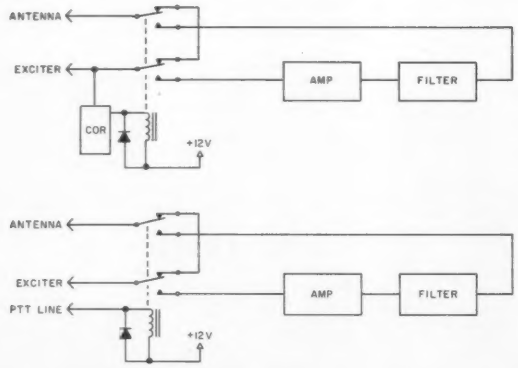


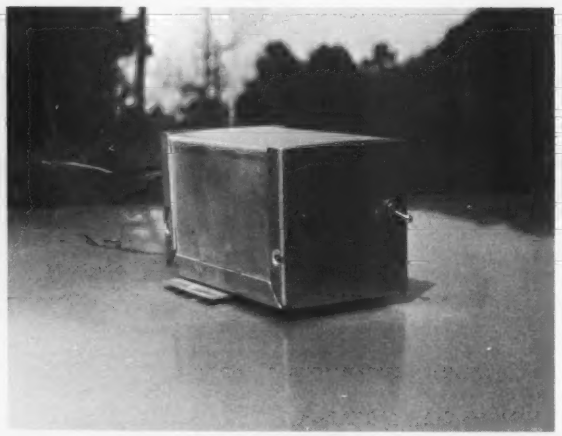
Fig. 1. Block diagram using COR (top) and transceiver PTT line.

With varying degrees of success, I have converted several CB transceivers for use on 10 meters; the most recent was a Realistic TRC448. After conversion, the transmitter would produce only 1 Watt AM and 4 Watts SSB. I felt that a little more power would provide a more satisfactory mobile signal. What I needed was a small linear amplifier, preferably solid state.

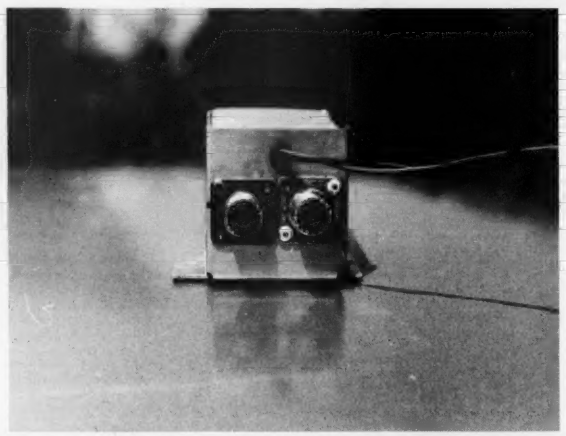
One of the primary reasons for converting a CB radio in the first place was cost, so any power amplifier used would have to be inexpensive to build. Ideally, it could be built using parts from the junk box.

After spending considerable time digging through old magazines and books, many circuits were found, but all of them failed to meet my requirements. They either used vacuum tubes (too much current drain), produced more power than I wanted (I wanted only 40 or 50 Watts), or used more than one power transistor, adding to the cost of construction. I was just about ready to forget about more power and use what I had.

A few days later I found what would possibly meet the requirements I had set for an amplifier: It was inexpensive, solid state, and had low current drain. A friend had a small amplifier that had originally been manufactured (illegally) for the CB market. Like most amplifiers of this type, the manu-



The front of the amplifier shows the power switch on the right and the LED power indicator on the left.



The rear view shows the placement of the SO-239 rf connectors and the power leads.

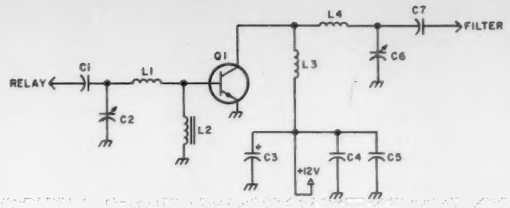


Fig. 2. Power amplifier.

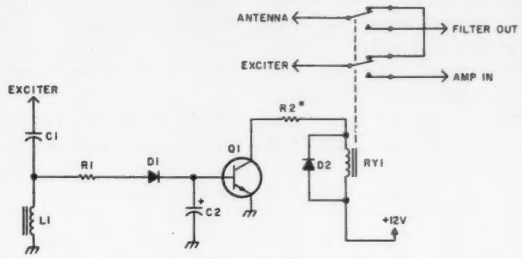


Fig. 3. Optional COR circuit.

facturer did not put his name or address on the unit so that no information was available on the circuitry. The only way to find out about the circuit was by drilling out the pop rivets holding the cover and looking inside. After much discussion, my friend agreed to let me take his amplifier apart.

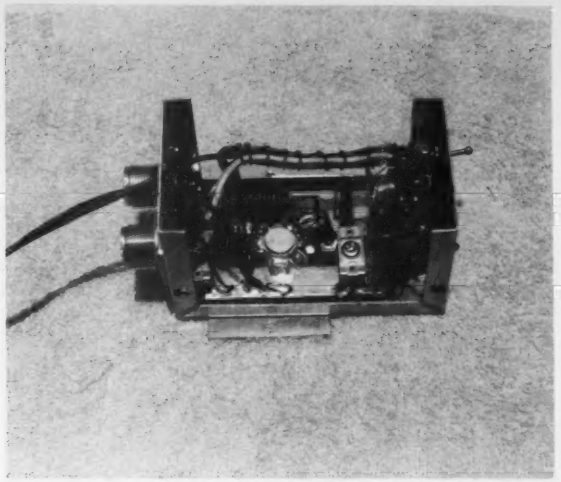
Once the cover was removed, I saw that in its present state this was not what I was looking for. The circuit board was poorly laid out, the power transistor was not mounted on the board but was located on the side of the enclosure and had rather long lengths of wire running to the circuit board, and there was no output filtering.

The only redeeming factors for this amplifier were its simplicity and the availability of the parts used in it. It was definitely a junk-box project. The only part that I would have to buy would be the power transistor. With a new circuit board layout, perhaps some minor changes in component values, and output filtering, I should be able to produce a usable amplifier.

The input and output coils were each reduced by half a turn, L1 from 4½ to 4 turns and L4 from 3½ to 3 turns. The shank of a 5/16" drill bit was used as a form for each of these coils. They are wound of 16-gauge, solid-copper wire, either bare or enameled, and the spacing between turns is approximately equal to the diameter of the wire.

The collector choke, L3, was close-wound of 22-gauge hookup wire (enameled could be used). A ¼" drill bit was used as a form for this coil. Input capacitor C1 was changed from 220 pF to 330 pF.

A new circuit board that would be easy to make and that would allow all of the



The first amplifier constructed did not have a heat sink as large as later units. The only heat sink used other than the enclosure was a small strip of aluminum used as a mounting bracket. This proved to work well when the amplifier was mounted on a metal automobile dash. The COR circuit board and relay are seen in the right end of the enclosure. The COR board was soldered to the amplifier board to facilitate mounting and conserve space. The enclosure shown in this photograph measures 2¼"×2½"×4". In later versions, a larger enclosure was used.

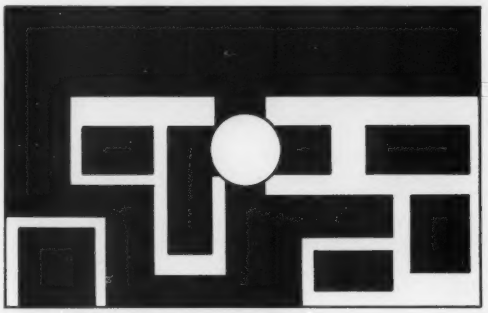


Fig. 4. Power amp PC board.

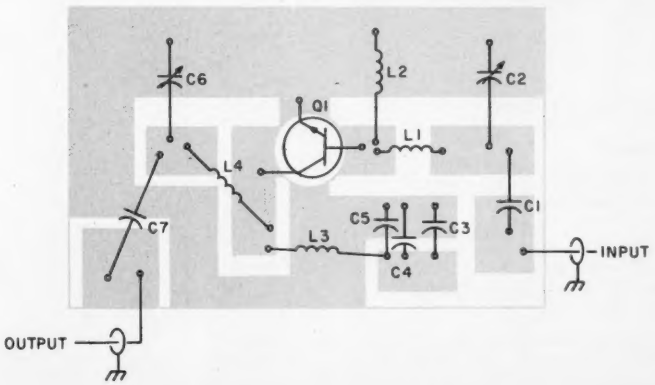
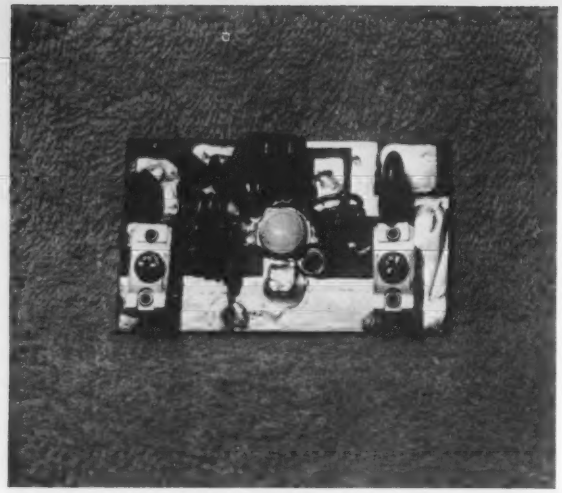


Fig. 5. Power amp parts placement.



Circuit board of the first amplifier constructed. It used a flange-mounted power transistor rather than the stud-mounted MRF455A specified in the parts list. Later units used MRF455As because they only require a single round hole in the board, making them easier to mount. The input pad is at the upper left, the output at the upper right.

Parts List

Power Amplifier

C1	330 pF	NE*	$ .26
C2, C6	55-300-pF compression trimmer	FS*	
C3	.01-μF disc	FS	1.35
C4	.001-μF disc	FS	.09
C5	1-μF 50-volt radial leads	FS	.16
C7	1200-pF, 1-kV dipped mica	NE	.75
L1	4 turns ⅜" long (see text)		
L2	1.8 μH	FS	.24
L3	9 turns (see text)		
L4	3 turns 5/16" long (see text)		
Q1	MRF455A or equivalent	NE	14.08

COR

C1	220 pF	NE	.26
C2	1-μF, 50-volt radial leads	FS	.16
D1	1N914, 1N4148, etc.	FS	.08
D2	1N4004 or equivalent	FS	.12
L1	1.8 μH	FS	.24
R1	470 Ohm, ¼ Watt	FS	.25 (for 5)
R2	see text		
Ry1	DPDT 12-volt coil relay	FS	1.80
Q1	2N2222 or equivalent	FS	.90

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1 SPST switch		RS	1.99
1 red LED indicator		RS	.79 (for 2)
1 series resistor for LED (use 470-Ohm resistor from COR)			

* NE—Newark Electronics, 500 N. Pulaski Rd., Chicago IL 60624; FS—Fuji-Seva, Box 3375, Torrance CA 90510; RS—Radio Shack.

components to be mounted on it was designed. I used 1/16" double-sided fiberglass circuit board with etching on one side and the foil left intact on the bottom. Components were soldered directly to the foil pads on top of the board. There is only one hole drilled, in the center of the board—the one for the power transistor. The power transistor mounts through the hole; its stud goes through the box used as an enclosure, and a 1/16" thick piece of aluminum was used as a heat sink. (The aluminum should be the same length and width as the enclosure.) Small spacers should be used between the circuit board and the enclosure to support the board. No strain should be placed on the transistor leads, and care should be exercised when tightening the nut on its mounting stud.

Tune-up of the amplifier is simple: Connect the exciter (3 or 4 Watts AM or CW) to the input of the amplifier and a 100-Watt power meter and a 50-Ohm dummy load to the output. Adjust trimmer capacitors C2 and C6 alternately for maximum power output. When maximum output is obtained, adjust C6 for approximately 50 Watts output. Compression or expansion of coils L1 and L3 may be necessary to obtain maximum output. A 12-volt power supply capable of supplying 5 to 6 Amps of current or a 12-volt battery should be used as a power source during this procedure.

The MRF455A is rated for 60 Watts when used with a finned heat sink, but neither the transistor nor the heat sink (the aluminum plate) gets warm during normal use. Care should be exercised during tune-up to keep the output near 50 Watts, or the transistor may possibly be overheated.

There are two ways of controlling the amplifier: by using a COR (carrier-operated relay) or by using the PTT line in your transceiver. If your transceiver uses relay switching, as mine does, it is a simple matter to run a control line from the PTT line to the amplifier-control relay. If you have electronic switching, the COR probably will be the easier way of controlling the amplifier; a schematic and circuit board layout are included with this article. The value of the electrolytic capacitor on the base of the switching transistor will have to be changed for use on SSB; 10 μF should be about right.

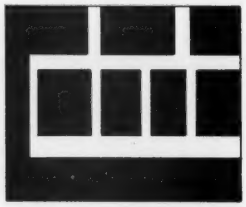

Fig. 6. COR PC board.

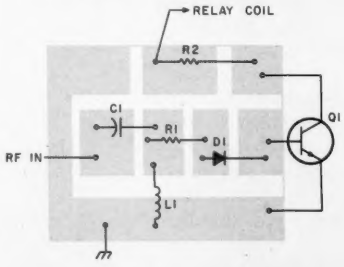

Fig. 7. COR parts placement.

Depending upon the relay used, the 200-Ohm resistor in series with the relay coil may be omitted or its value adjusted for positive switching (the relay in my amplifier would not drop out without the resistor).

A filter is needed on the output of the amplifier before putting it on the air. It may be an external filter or it may be built into the same enclosure that houses the amplifier. I used a tunable low-pass filter that I had bought at a hamfest. I tuned the filter for minimum interference on TV channel 2. (The filter has seven tunable sections.) I don't know how much this attenuates the second harmonic, but after tuning there was no interference to the TV receiver.

The amplifier is broadbanded and should work equally well on other bands. For this reason I have not included parts values for an output filter. Several suitable filters are discussed in chapter 15 of my *Radio Amateurs Handbook*.[1] Particularly interesting are the Chebyshev low-pass and the "Citation-Eliminator" filters on pages 15-7 and 15-8. I have not, as of yet, tried either of them.

The parts used in the construction of this amplifier are readily available. Mine, with the exception of the MRF455A, was built entirely out of parts that I had in my junk box. If all new parts are used, it can still be built for under $50.00. Parts sources and prices are given in the parts list. (If you shop around you can probably find lower prices.) I can supply etched and drilled PC boards for $7.50 and an SASE per pair.

I will try to answer any questions if they are accompanied by an SASE. ■

[1]American Radio Relay League, Newington, Connecticut, 1979 Edition.

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TVRO Troubleshooting

Get your Earth station off the ground with these signal-enhancing hints.

My head swells to twice its usual size every time I complete a home-brew project. After all, there is nothing quite like the feeling that accompanies turning a handful of parts into a living, breathing circuit. But then again, there is nothing worse than a project that *doesn't* work. My first experience with a satellite TV system taught me that. No need to worry about a swollen head; just give me a corner to hide in while I do the troubleshooting.

It's one thing if we are talking about a three-chip keyer that you have a grand total of $5.00 and two hours invested in. But watch out if the investment is in the thousands of dollars and hundreds of hours, not to mention promises made to family and friends. Perhaps the only thing worse than a TVRO system that shows no sign of working is a TVRO that puts out poor quality pictures. *"Is that the best it can do?"* the neighbors ask.

The problem isn't the satellites; it's just that getting a TVRO up and running isn't the same as taking a $2000 ham radio transceiver out of the box and making your first QSO ten minutes later. Troubleshooting is almost always called for. Even if you buy most of the components for TVRO, it takes some fine tuning. However, a dB here, a dB there, and pretty soon you'll have a picture that does justify a swollen head.

Gain Without Strain

You have to start somewhere, and unless you *know* what is wrong, I suggest you begin with the antenna. Backtrack a few steps and take a close look at the way your antenna is built. The gain of a parabolic dish is highly dependent on the accuracy of the surface. Most commercially-built antennas claim efficiencies between 50 and 60 percent, based on a surface accuracy where all errors are less than ± 1/16 of an inch.

You can't just give your antenna an eyeball diagnosis. A thorough checkup is in order, using either a carefully-made template or the mirror method described by Steve Gibson in the April, 1982, issue of *73*. The final check on your antenna's surface accuracy should be done while it is in operating position and subject to everyday stresses.

If the patient seems to be in danger, take preventive measures before proceeding. A one- or two-piece molded dish that is out of spec could spell disaster while antennas made from petals can sometimes be strong-armed into shape. But beware of a need for excessive pounding or bending. The whole surface should be accurate, not just one side! Luckily, commercial antennas have become much more reliable in recent months, but do check them carefully before you buy.

If you home-brewed the antenna, then there is no one else to blame but yourself. Wood-frame dishes covered with window screen have become popular and they work well. Just make sure that each of the ribs is sanded down to match the master and that the screening is carefully applied. Bulges, ripples, and excessive overlapping will cost you gain. If you have built a spherical antenna (sometimes called an 8-ball or McCullough dish), spend an extra afternoon adjusting the tensioning bolts. Then erect the framework and recheck the curvature before installing the screen. This beats trying to smooth out the surface after it has been stapled into place.

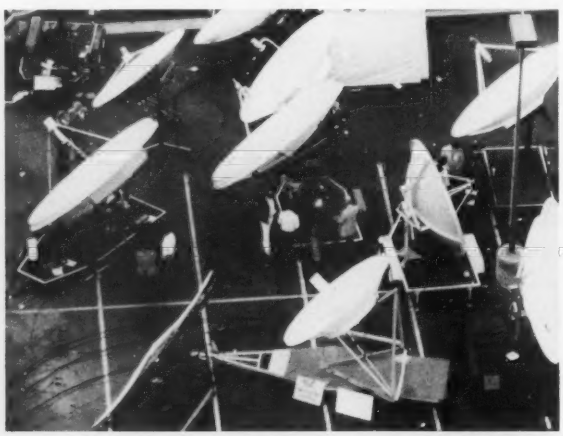

Photo A. Follow the crowd and point your antenna in the same general direction as everyone else. Be sure to include declination in your azimuth calculation.

Perfect Pointing

Once you are convinced that there is no way to squeeze another ounce of gain from the antenna surface, ask the question, is it pointed in the right direction? Don't laugh and turn the page. Photo A shows the value of going along with the crowd. But the chances are that you don't have twenty other satellite antennas in your backyard to use as references. Assume noth-

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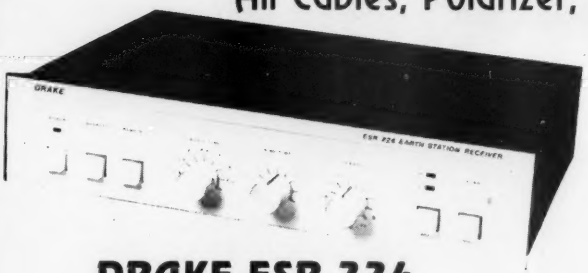

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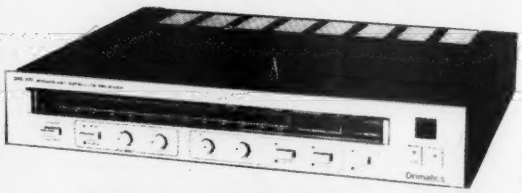

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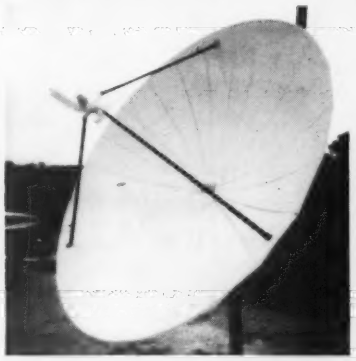

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ing and go dig out the January, 1982, issue of *73*. On pages 60–62 is Steve Gibson's cookbook on satellite finding.

Follow the equations carefully. Better yet, have your ten-year-old work through the numbers. When you are done, assuming you live in the northern hemisphere, the bearing you arrive at should be somewhere on the southern horizon. Chances are it will be something like 238 degrees (New Hampshire) or 202 degrees (New Mexico). The elevation could be less than ten degrees if you live in the Arctic or as much as ninety if your QTH is on the equator.

The next step sounds simple but isn't. Is the dish pointing in the direction that the numbers say it should? You will need some sort of compass and inclinometer to find out and you must know the declination for your location. There are a hundred and one places to find the declination, or how far true north is from magnetic north. You can ask at the local airport, check a topographic map, or find a knowledgeable Boy Scout. The important thing is to include declination correctly in your antenna aiming.

Checking the elevation of the antenna isn't too tough. A protractor, along with a string and small weight, can be used. Or you can go whole hog and buy an inclinometer at the local hardware store (see Photo B). The method is up to you, but check and double check the azimuth and elevation of your antenna. Don't stay up nights worrying if you can't get the antenna perfectly aimed. After all, the compass and inclinometer have limited accuracy, so you'll need to do a little jiggling anyway to get the best picture.

We have been operating under the assumption that the only thing between your antenna and the satellites is a lot of air and maybe the occasional sea gull or pigeon. If the situation is otherwise, you may have built a nice piece of outdoor sculpture rather than a satellite dish! Buildings, trees, fences, and even a phone pole will absorb microwaves, so before you pour the concrete, make sure that the antenna has a clear shot at not just one bird but all across the satellite belt. The farther north you live, the more you will have to worry about obstructions, thanks to the decrease in antenna elevation angle that occurs as latitude increases.

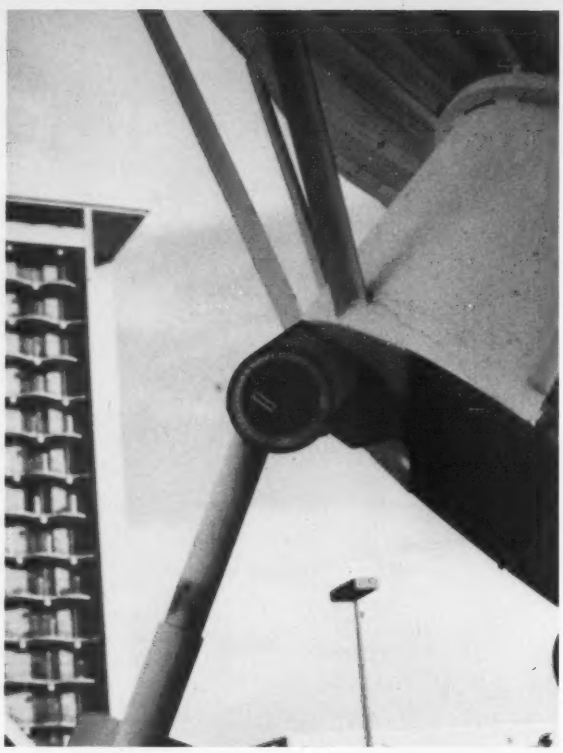

Photo B. An inclinometer is helpful for determining the elevation of your antenna.

If a potential antenna site looks shaky, consider another location. Consider even a roof-mounted antenna as shown in Photo C. You can check a location by running a test with a portable antenna. This can confirm a clear path and tip you off about any problems that might result from earthbound microwave signals. But remember, even a field check can backfire. Consider the plight of one TVRO owner who shortly after installing a system found that his neighbor was building a garage that would stand directly in the signal's path! Like all other aspects of setting up a satellite terminal, site location must be done with care.

Feedhorn Fun

Assuming that the antenna is built right, located in a good spot, and aimed correctly, it is time to consider the next link in the TVRO chain, the feedhorn. Start by making sure that your feedhorn matches the antenna. Feedhorns are not created equal, and besides ending up with a downright poor one, you also could lose out if the horn over-illuminates the antenna (picking up unwanted ground noise) or under-illuminates the dish (which is the same as throwing part of the signal away). Perhaps the most popular horn for parabolic antennas is the scalar feed, sometimes called the Birkill, coaxial, or Chapparell feed. If you bought a budget-priced TVRO package, you may have the more traditional horn feed. In that case, it might be worthwhile to upgrade.

Besides matching the feed to the antenna, it is important to position the horn correctly, as shown in Photo D. If you don't, precious microwaves will be wasted. Find out what your antenna's focal length is and then measure out an equal distance along a line perpendicular to the center of the dish. The front edge of the feed should fall close to this point. Your feedhorn mount also deserves close attention. Not only must it be adjustable, but it also should be reasonably solid with no sagging. If you are using a home-built affair, avoid metallic or large supports that could degrade performance.

When the feedhorn is in its final position, it should point squarely at the center of the dish. If you have to point it to one side to get the maximum signal, it indicates that the dish surface is not right. As the feedhorn is adjusted, you should find one spot that gives the best signal. Any movement greater than ½ inch or so should cause the signal level to drop off. If you don't get a pronounced peak or if there are several peaks, then the dish needs attention.

Before giving the system a smoke test, it would be wise to check out the LNA. Is it attached securely to the horn with no gaps at the waveguide junction? Verify that the feedhorn/LNA combination is aligned for either horizontal or vertical polarity. If you are using a TV rotor, it might be best to leave it disconnected so that the horn can be twisted by

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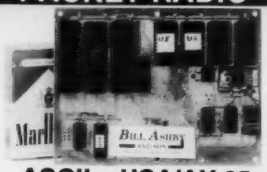

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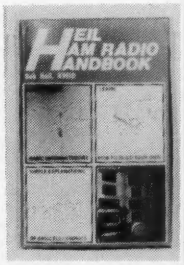

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hand during the initial alignment. Or, if you want to go first class, consider replacing the rotor with a feed that has built-in polarity switching via a miniature motor or electronic rotation.

Make sure that the correct voltage is being supplied to the LNA. You may not be able to do this with LNAs that use the rf feedline to carry the power supply voltage, but no matter what kind of receiver or LNA you are using, don't scrimp on the cable that connects the two. Remember, you are not hooking up a CB radio. RG-58 won't hack it nor will hardline if you do a lousy job soldering the connector. By taking the time to do the job right, you'll reduce the possibility later of moisture ruining your signal.

D-Day

By now you are probably itching to make a smoke test. To make life easier, take the receiver (if it is an indoor type) and a TV set out to the antenna. This helps to avoid wild-goose chases that result from bad cable runs, and it makes it simple to observe the results of any adjustments you make. Before you throw the switch, double check all the connections. Don't be like one fellow who, in his excitement, forgot that he needed an rf modulator between the receiver and the TV set!

The next few steps are critical. To get the best possible picture, you'll need to adjust the antenna, feedhorn, and possibly the receiver. Although the adjustments don't usually interact, it is important that you deal with only one at a time, proceeding to the next step only after you complete the previous one.

Start with the antenna. If it has an az-el (azimuth-elevation) mount, leave the elevation setting alone and carefully vary the azimuth position. A swing of ten to fifteen degrees in either direction should yield a signal.

Photo C. If you can't find a suitable spot on the ground for your antenna, consider using a roof. It almost guarantees a clear shot at the satellites.

If it doesn't, recheck the elevation and original azimuth settings. If your antenna has a polar mount, it must be aligned against the north-south axis. Then you should be able to swing it through an arc without changing the elevation setting.

The first signal you receive may or may not be video. Don't be surprised if you get a jumbled screen and audio that sounds a bit like radioteletype or badly-mistuned sideband. All that you have to do is try another transponder on the same satellite or possibly readjust the antenna so that it points at one of the television birds. If you find yourself lost, return to the initial signal and verify that everything is still working.

Before you start scanning the sky in search of new satellites, it would be a good idea to get the feedhorn shipshape. All that should be necessary is a minor adjustment of its distance from the center of the dish and the polarity. Any substantial movement from side to side spells trouble. If you are using a spherical antenna, then proper placement of the feedhorn is crucial since it also determines the direction the antenna is pointing.

Peaking the signal requires that you have a steady source. Stick to one satellite and one transponder—preferably one that is transmitting color bars. The strength of such a signal will vary over time but will certainly be more reliably constant than signals from different transponders or, heaven forbid, different satellites.

Hopefully, your receiver has a signal-strength meter built in. Lacking that, there may be a terminal on the back for attaching an external meter. Or, as a last resort, you can use the screen as a reference. If you choose this route, it is imperative that the TV be located where the person making the adjustments can see it. Don't waste a lot of time making adjustments that you "think" are improving the picture. After all, there is a limit to anyone's ability to discern a change.

If you have gotten this far and made everything work, then you don't need any more advice from a magazine article. On the other hand, if you think you might be ready to forsake satellite TV for another hobby like stamp collecting, don't—at least not yet. For the time being, assume that the electronic part of the system is working. Concentrate your efforts on the antenna and feed. If your initial 20-degree sweep didn't work, make a slight change in the elevation setting and try another sweep. After a couple of tries at this, go back to the original azimuth and elevation settings and reposition the feedhorn. Repeat this sequence until you have systematically exhausted all reasonable positions.

Problems?

Still no luck? Then assume that something is wrong with the electronics. The best way to find the culprit is through the "buddy system." You need someone with a working TVRO who will let you try your receiver and LNA. Or, you could borrow their LNA and receiver to try with your antenna. This method of substitution is not terribly elegant, but it does work and sometimes is your only alternative when you lack test equipment.

Assuming that you have a commercially-built LNA, there is little that can be done besides verifying that it is hooked up correctly and the power supply is functioning. Manufacturers threaten to void the warran-

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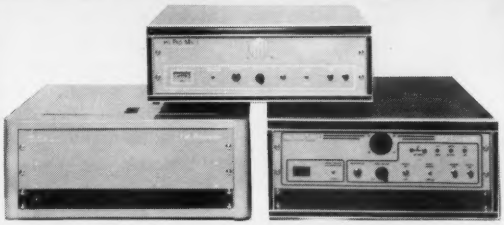

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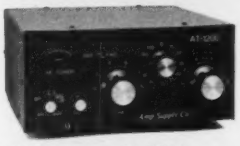

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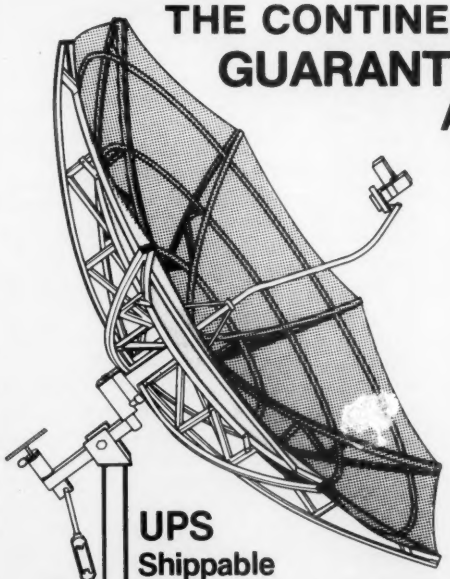

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ty if you open up an LNA, and with good reason. There are no user-replaceable or -adjustable parts; all that you are likely to do is foul something up! Although receivers are not quite as touchy as LNAs, there is little that can be done to one if you don't have some sort of signal generator and a decent oscilloscope. Randomly tweaking the i-f cans with the hope that some miracle will occur is a sure invitation to disaster. The manufacturer may provide a few tips on what can or can't be adjusted by the user; as a last resort, you may want to give them a try.

Let's shift gears and look at some of the problems that you may have even though you are receiving pictures. The first problem is what satellite TV aficionados call "sparklies," otherwise known as snow. Sparklies are the result of noise that overpowers part of the signal.

The solution lies in boosting the level of the signal or reducing the amount of noise. The primary mechanisms are the antenna and the LNA. Is the antenna big enough? Is it providing the expected amount of gain? Does the LNA have a low enough noise figure? If you are convinced that your antenna is up to snuff, your only alternative may be a better LNA. Switch from a 120-degree unit to a 100-degree one. Obviously, this is an expensive fix and should be attempted only after you have tried everything else.

Adding another amplifier after the LNA probably won't help. By that stage, the noise is already present and a new amplifier will increase both it and the signal. A line amplifier could come in handy if you have a very long coax run between the LNA and receiver. This addition won't make up for a poor LNA or antenna, but it does ensure that the receiver has enough signal to work with. Line amplifiers also are used when one LNA drives several receivers.

Photo D. Feedhorn placement is critical. Start by finding your antenna's focal point and then make slight variations in the feedhorn position until the signal is maximized.

It may be hard to believe, but you can get too much gain. The result will be pictures that tear and smear. The solution is pretty simple: Just add some loss before the receiver. Loss can be had cheaply; a piece of coax should do the trick.

A TVRO can be likened to a chain and yes, this chain is only as strong as its weakest link! A good rule of thumb is that the first two links, your antenna and LNA, will have the biggest role in determining overall performance. Stephen Gibson's "Satellite Central" articles in the November and December, 1982, issues of *73* are well worth rereading if you are unsure of how strong each link must be. Remember that a combination that works well in one location may be less than optimal somewhere else. Satellite signals vary and receivers have special quirks. For example, a receiver with a PLL detector may be great for marginal signals but not so great for strong signals.

Another problem that you could encounter is drift. Frequent tweaking of the tuning dial might indicate an unstable oscillator stage. This problem is more apparent in single-conversion receivers but can plague double-conversion units, too. Pictures great but the audio is lousy or just not there? Remember that the audio is on an FM subcarrier and is processed separately from the video. The audio on most North American entertainment transponders uses a 6.2- or 6.8-MHz subcarrier. Is your receiver's audio control set correctly? Some services, like Music Television (MTV), may require special audio processing.

The final problem I'll address is probably the toughest to cure. You know that your TVRO is working because you are receiving some kind of signal. Unfortunately, this signal doesn't make any sense and you might receive it regardless of where your antenna is pointed. The culprit is terrestrial interference, land-based microwave signals that are in or near the 4.0-GHz TVRO band. As an unlicensed home-terminal owner, you pretty much have to grin and bear it.

Short of moving, there are two solutions, First, prevent signals from reaching your system. Use your LNA and receiver to sniff out the direction the offending signals are coming from and then locate your antenna so that something, let's say a house, stands between it and the signal source. If there is no way to completely shield the system, then you might try filtering out the interference. The success of this approach depends on the relative level of the interloper. You can avoid most terrestrial interference problems by doing a thorough site check and, when needed, using an antenna that doesn't pick up unwanted side or ground signals.

Building your own TVRO is not easy. Sure, you can take the easy way out and plunk down a bundle of cash and have a pro install a system for you. But thousands of hams have taken on the challenge themselves and succeeded. A smaller number of adventurous souls have built everything from scratch. A few relied on luck, but most learned the basics and paid attention to details. Learn from their experiences. Heed the fundamentals. Don't cut corners. Soon you'll have a working TVRO and a well-deserved swollen head. ■

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NEW BT-1

The **BT-1 Basic Trainer** is a hand-held computerized unit which teaches the code one character at a time at 18 or 20 words per minute. The BT-1 contains a self-paced training program that allows serious students the possibility of learning Morse to 20 wpm in as little as one month! Each character represents a separate practice session in which the character is first introduced by itself, and then presented 50% of the time along with all previously learned characters. There are no tapes to memorize, wear out, or break. No programming skills are necessary; the BT-1 is very easy to use. The tone oscillator can also be keyed for sending practice. An earphone jack is provided for private listening. The BT-1 will go as high as 99 WPM in 1 WPM increments. A battery operated version, the BT-1P, is available with wall charger and internal NICAD batteries.

NEW KT-3

The **KT-3 Keyer-Trainer** unit uses the teaching program used in the BT-1 trainer. In addition, the KT-3 features a full function Morse automatic keyer for keying any modern transceiver, or for sending practice. Speed range is 18-99 wpm for transmitting and 1-99 wpm for training.

KT-2 Keyer Trainer

The **KT-2 Keyer-Trainer** is a computerized keyer with all the features shown above, plus a Morse proficiency trainer. It is designed to increase your existing code as quickly as possible. The unit can be set for beginning practice speed, ending practice speed, and duration of practice. The microcomputer does all the rest by gradually increasing the speed during the practice time selected. You can even select between fast code (Farnsworth) or slow code methods. The characters are sent in 5 letter groups, or random word lengths. Two levels of difficulty can be selected; common Morse characters or all English Morse characters. A 24,000 character answer book is provided for the 10 separate starting positions. There is also random practice mode for which no answers are available.

CK-2 Contester™

The **CK-2 Contester™ Keyer** is the lowest cost automatic keyer available featuring an automatic serial number generator for contesting. The CK-2 keyer features a large 500 character message memory that can be soft-partitioned into as many as 10 sections. An exclusive AEA edit mode makes it possible to correct mistakes made while entering messages or to insert words into previously established messages. Two different speeds can be set for fast recall in addition to a stepped variable speed control. The CK-2 features an automatic message repeat mode with variable delay-before-repeat for automatic CQ transmissions or TVI testing.

MM-2 MorseMatic™

The **MM-2 Morsematic Keyer** represents the most sophisticated paddle keyer ever designed and features two powerful microcomputers. The Morsematic incorporates virtually all the features (except the preset and stepped variable speeds) of both the CK-2 and KT-2 shown above. In addition, the MM-2 offers an exclusive automatic beacon mode which is invaluable for meteor scatter, moonbounce scheduling, or beacon operation.

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Streamline the IC-25A

Add a dual-speed vfo and remote control. You can do it in a few easy steps.

Living within a mile of a local repeater, I had been experiencing a severe desense and cross-modulation problem with my "brand-X" rig when listening to other repeaters. The local repeater was annihilating the front end of brand-X. The ads for the new Icom IC-25A were very appealing, and I decided to try another radio as a solution to my problem.

One look at this mighty midget and my plastic money was on the counter, and the Icom was mine! If you haven't seen this little rig, you are in for a treat. It has all varieties of bells and whistles, and the design and craftsmanship are superior. It is so small (2"H × 5½"W × 7"D) that it suggests many convenient hiding places for a mobile installation. Furthermore, the desense problem experienced with my other rig was nonexistent in the Icom, even when parked beneath the antenna of the local repeater.

As with most rigs, we hams always want to change or add something, and the IC-25A was no exception. The two vfo's provided did not seem to give me any added flexibility; in fact, they created a difficulty. Using the 15-kHz vfo, I often would dial to some desired frequency and then find that I was either 5 kHz too high or 5 kHz too low. Then I would have to switch to the slow 5-kHz vfo and dial it to the desired frequency. This was frustrating and time consuming, so I decided to eliminate the dual-vfo feature and create a single, two-speed vfo.

Another convenience I wanted was a remote scanning control. The IC-HM8 touchtone™ microphone supplied with the IC-25A did not have this feature, so I decided to add it to the mike.

Memory retention was another item considered, but the thought was abandoned when I could not find space to mount a battery inside this very compact transceiver. Furthermore, I learned that Icom has available a memory-holding device identified as BU-1 which fits between the two halves of the external power connector.

You will find that the following changes make an excellent little rig even bet-

Photo A. New scanning switch installed.

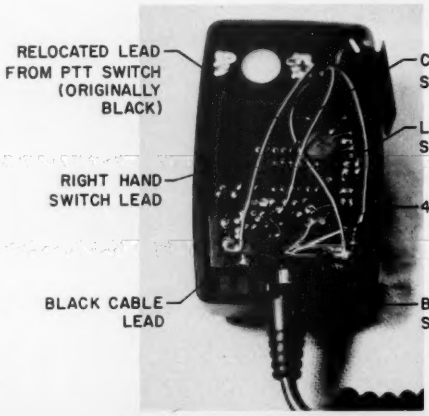

Photo B. The scanning switch wiring.

ter! In performing the modifications, the technician should refer to the comprehensive schematics and pictorials furnished with the IC-25A.

For convenience and selection, these modifications are identified separately as Mod A, B, and C. It is suggested that you read all three mod instructions before proceeding, to help you decide which ones you may want to accomplish. These changes are not difficult, but they do require some expertise in working on solid-state circuitry and printed circuit boards. Therefore, this work should *not* be attempted by "first timers."

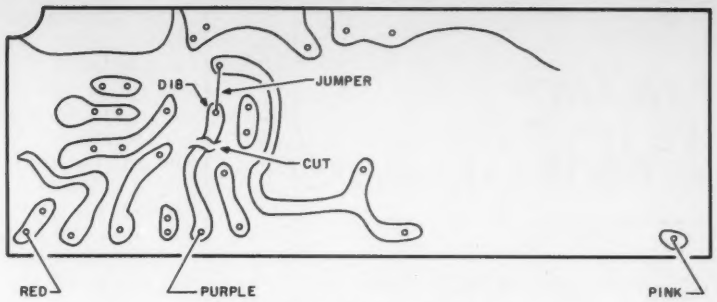

Fig. 1. Switch board, foil side.

Mod A

This modification converts the dual vfo to a single vfo with two-speed control. Also, the existing fast-speed dial rate is changed from 15 kHz to 25 kHz. The original vfo push-switch now becomes a slow/fast dial rate selector. It also functions to change the rate during the full-range-scan mode.

1) Remove the top and bottom covers of the IC-25A. When removing the lower cover, unplug the speaker from the mating plug on the PC board.

2) Remove the four front-panel knob controls (Vfo/Memories, Main Tuning, Volume, Squelch). All knobs will pull off their shafts. The large tuning knob may be tight and may require gentle, simultaneous prying underneath two opposite sides. Use two table knives with pieces of cardboard underneath them to protect the face of the panel. Pry up evenly.

3) Remove the two top screws and two bottom screws and carefully slide off the front, black bezel (panel).

4) Remove the two screws on the left side and two screws on the right side that hold the front control assembly to the main chassis.

5) Carefully move the front control assembly forward to separate it from the main chassis.

6) Take off the retaining nuts and remove the volume and squelch controls from the front control assembly. Place them carefully aside. It may be necessary to free their wiring from the harness assembly by cutting a wire-wrap.

7) With the unit and front control assembly upside down, locate the switch board assembly. It is a small PC board situated directly behind the three push-switches (Scan, Simplex, Norm).

8) Refer to Fig. 1 and locate the *red* wire at the extreme *left* corner of the switch board. Unsolder this lead and lengthen it by splicing a 1½" piece of wire to it. Solder the end of this extension to the *pink* wire located at the extreme *right* corner of the switch board. This wire relocation creates the single vfo with the original tuning rates of 5 and 15 kHz.

9) Refer to Fig. 1 and locate the *purple* wire on the edge of the switch board. From this connection point, follow the board foil up to its end where there is a single soldered connection. This connection is the cathode end of diode D18. Using an X-acto® knife (or other sharp blade), very carefully cut across the foil below this point. This action disconnects D18 from the purple wire. Check with an ohmmeter between the purple wire and the D18 solder point to make sure that you have completely severed the connection.

10) Using a small bare wire, solder a short jumper from the isolated connection point of D18 to the board foil directly *above* it, as shown in Fig. 1. Be careful not to bridge any solder to adjacent areas. This action converts diode D18 to a new function as D32 and creates the faster dialing rate of 25 kHz.

11) Carefully replace the volume and squelch controls in their original positions with their locating tabs in the proper holes. Secure them with the original nuts.

12) Reattach the front control assembly to the main chassis with the original four screws.

13) Reassemble the panel bezel on the front control assembly with the original four screws, and press all four knobs back in their proper place.

14) Take the bottom cover and plug the speaker lead back in place with its mating connector on the PC board. Observe the plug polarity. Place top and bottom covers in place and secure with original screws.

After this work is completed, you will have a single vfo with the A-B vfo push-switch now functioning to change from a slow to a fast tuning rate (5 or 25 kHz). The yellow light above the switch will now stay lit at all times.

Mod B

If it is desired to create the single vfo but maintain the original tuning rates of 5 and 15 kHz, then perform Mod A but do only steps 1, 4, 5, 7, 8, 12, and 14. After this work is performed, you will have a single vfo with the A-B vfo push-switch now functioning to change from a slow to a fast tuning rate (5 or 15 kHz).

Mod C

This mod is to install an UP-DOWN scanning-control switch on the IC-HM8 microphone.

1) Obtain a subminiature SPDT toggle switch, *center OFF*, momentary contact (Calrad P/N 40-584 or equivalent).

2) Remove the single screw and take the back cover off the microphone.

3) Gripping the PC board at its edges, carefully lift it upward. This will unplug it and separate it from the mating plug on the tone pad. While still connected, lay the PC board aside exposing the inside of the mike case.

4) There is an oval hole existing in the case directly below the microphone element location. Carefully drill a ¼" hole through the center of this oval. It is best to drill a pilot hole with a small drill (i.e., 1/16") and enlarge the hole slowly by increasing sizes to ¼". Make the pilot hole from the inside out, but enlarge the hole from the outside in. This will prevent pushing and loosening of the front panel.

5) Remove all hardware from the switch shaft and install it in this hole. It will be necessary to fabricate one

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or two spacing washers to provide a flat contact for the nut. Use a ¼" washer and cut or grind off one edge up to the edge of the ¼" hole. Secure the switch with a nut (refer to Photo A).

6) Cut three 5" lengths of #22 wire and solder one to each of the three switch terminals. Place these wires so that they protrude from the top of the mike, and then plug the PC board back in position.

7) Unsolder the black lead from the PTT switch where it connects to another black lead from the cord at the bottom of the PC board. Connect this black lead to the same ground point on the PC board as the braided shield wire from the cable.

8) Take the center wire from the new switch and connect it to the same point where the black PTT wire was just removed. This connects it to the black cable wire.

9) Take the left-hand switch lead and connect it through a 470-Ohm resistor to the ground foil on the PC board.

10) Take the right-hand switch lead and connect it *directly* to ground on the PC board. (See Photo B for connections.)

11) Replace the back cover and secure with the screw.

12) Open the connector on the other end of the cable, unsolder the black lead from lug 6, and resolder it to lug 3.

13) Reassemble the plug.

This completes the modification and you now have UP-DOWN scan control from your microphone. This feature does not affect the normal operation of the S/S scan switch on the front panel of the IC-25A. If desired, the length of the plastic bat handle on the new switch may be cut to a shorter length. ■

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A Perfect Match for the HW-8

Heath's little rig is the QRPer's dream come true. So is 30 meters. Join them with this super-fast mod.

On October 28, 1982, the Federal Communications Commission opened up most of 30 meters to US amateurs. Those of us with newer rigs were able to get on the air by adding a new dipole to the antenna farm or by finding a new tap on the antenna tuner coil. However, most of us with older rigs were faced with the possibility of having to wait until we could get a newer rig. Many older rigs, like the Heath SB/HW series, would be a little difficult to modify.

QRP operators, though, are fortunate to have the much-modified HW-8 to play with. The purpose of this article is to describe a simple modification to allow you to convert your HW-8 to 30 meters with a crystal and three capacitors.

The HW-8 is a direct-conversion receiver which generates the local oscillator signal by mixing a crystal oscillator and a variable-frequency oscillator. This allows the vfo to run at one frequency and facilitates multiband operation. This same system allows easy conversion to other bands.

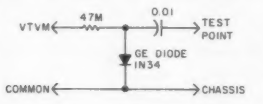

Fig. 1. Rf probe for alignment.

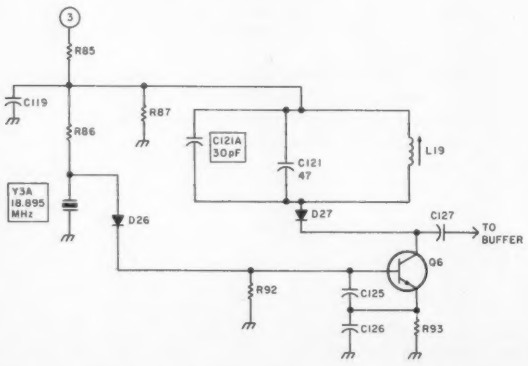

Fig. 2. HW-8 heterodyne oscillator, showing added parts C121A and Y3A.

In order to convert the HW-8 to 30 meters, all you need to do is change one of the crystals and realign the rig. I suggest that you change the 20-meter crystal. It appears to be easier to move the rf circuits at 20 meters down to 30 meters than it would be to move the 40-meter circuits up. In addition, the transmitter PA-output network is a low-pass filter, and moving the 40-meter low-pass up might require major surgery. This modification requires no surgery at all—only a few additions.

Once you gather the parts together, the entire conversion should not take you very long. Following are step-by-step instructions covering the conversion and realignment:

1. Referring to the Heathkit™ HW-8 circuit diagram, remove both covers, unsolder the 20-meter crystal, Y3, and replace it with the 30-meter crystal at 18.895 MHz.

2. Locate L19 and C121. Solder a 30-pF capacitor across L19 in parallel with C121. It is easiest to tack this new capacitor on the bottom of the circuit board. This facilitates reversal of the modification.

3. Locate C7 and C22 in the rf amplifier circuit. Add 60 pF of capacitance in parallel with each capacitor. I used two 30-pF capacitors across C7 and C22 each. Anything in the 60-pF range should work as well.

4. Replace the bottom cover. This completes the modification; only alignment is left.

5. Attach an rf probe and VTVM to the base of Q7. If you don't have an rf probe, use the circuit Heath suggests in Fig. 1. Adjust L19 for maximum response on the VTVM and then turn the coil slug ¼ turn counterclockwise. L19 is the *bottom* slug in the L19/L21 coil can.

6. Move the rf probe to the emitter of Q5. Adjust L15 for maximum response. You will have to move the coil slug almost to the bottom.

7. While listening to an on-the-air signal (WWV is convenient), adjust C7 and C22 for maximum received-signal strength.

8. Attach a 50-Ohm dummy load to the output, key the transmitter, and adjust C103 (in the final amplifier) for maximum output with the loading control at the 12-o'clock position.

9. If you want, you can calibrate the vfo using WWV at 10 MHz. Put the top cover back on.

10. Have your first QRP QSO on 30 meters.

The results are excellent. My HW-8 has a 30-meter power output of 1.2 Watts into a 50-Ohm load. Within two minutes after finishing the realignment, I worked NN4F in Memphis. He gave me a 579. I find that I can work stations on 30 meters easier than I can on 20 while using QRP. There is some high-power teletype on the band, but you can sneak around that.

The receiver performs fine although I have not been able to evaluate it for sensitivity and dynamic range. The converted HW-8 seems to work just as well on 30 meters as it does on any other band!

So there you have it; a thirty-minute modification to put you QRP on thirty meters. Come on down to 10.1 MHz and have some fun! ■

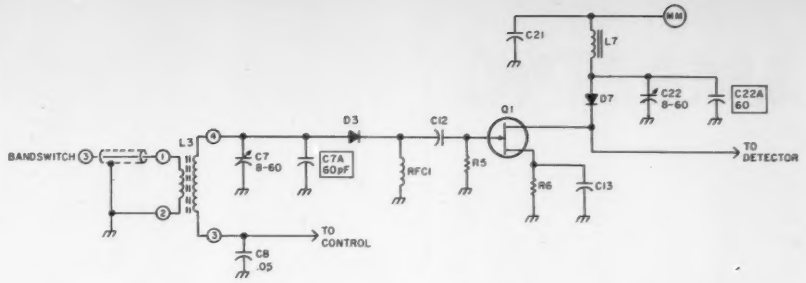

Fig. 3. HW-8 rf amp showing added capacitors C7A and C22A.

Parts List

Y3A	18.895-MHz crystal, type OF-L, cat. no. 031300, International Crystal Mfg. Co., Inc., 10 North Lee, Oklahoma City OK 73102. Price: $6.88.
C7A, C22A	60-pF capacitor, Radio Shack, Jameco, and other suppliers. Value of 50 pF to 70 pF acceptable.
C121A	30-pF capacitor, Radio Shack, Jameco, and other suppliers.

Capacitor values may be approximate and determined experimentally. I used 30-pF capacitors from a Radio Shack assortment, paralleling two to get 60 pF.

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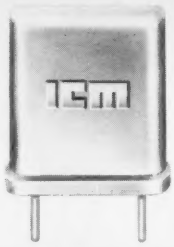

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Sincerely yours,

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Sincerely,

Richard Norton, WB5FRO

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Don Wallace: Superham

Meet W6AM, the Grand Old Man of amateur radio.

Author's note: Some of the material in this article was written by Peter K. Von Hagen WA6HXM. The author extends his gratitude to Mr. Von Hagen and also to *The Palos Peninsula News* for permission to reprint excerpts from his well-written article.

How many hams do you know who have been the personal radio operator for a US President, won the Hoover Cup for having the best amateur station in the nation, been the world's champion DXer for many years, and have mobile rigs in their automobiles operating with one kilowatt of power on the low bands and 250 Watts on two meters?

There is only one person among the hundreds of thousands of amateur radio operators in the world who meets the qualifications listed above, and many of you have probably already guessed his name and call: Don C. Wallace W6AM—the 85 years young Grand Old Man of Amateur Radio.

Early Years

Wallace was born in 1898 in Belview, Minnesota (current population: 439), where his father was a banker. The transfer of his father to another branch of the same bank in nearby and considerably larger Redwood Falls represented a step up the ladder, so the family moved there. In 1905, they moved to Los Angeles, where the population at that time was only one hundred thousand!

In 1908, Don began to peruse his father's physics books. He found out how doorbells, motors, etc., worked and, putting his new knowledge to immediate use, actually constructed a motor, a doorbell buzzer, a telegraph sounder, and a key.

Two years later, Don and his friend John Cook used number 18 rubber-covered wire to construct a five-block-long telegraph line between their homes. The line was fastened to telephone company poles for the four blocks before the tracks of the Pacific Electric Railway were encountered. Fortunately, the railroad had two poles very close together at that particular location, one on each side of the track. This facilitated running the wire under the rails to Cook's home a block further on.

This line furnished a lot of code practice and also served as an excellent antenna for Don's first crystal set until the wire running under the tracks was discovered by a railroad worker who, not knowing what his eventual destination would be, started coiling it up and finally delivered a very large coil of wire to the Wallace residence.

Don Wallace was a youngster with a huge curiosity. In those days, number 6 dry cells were used in a "make and break" circuit to produce square wave ac which could, of course, be stepped up to many thousands of volts to provide ignition voltage for the automobiles of that early age.

Don's uncle in Anaheim, California, with whom Don was visiting, had considerable trouble in starting his automobile due to weak batteries, so a trip was made to a nearby garage, and Don went along. Don asked the mechanic what he did with the old batteries, and the man pointed to a large pile of discarded cells in a back corner of the garage and told Don to help himself. He loaded about one hundred dry cells into his uncle's vehicle and hauled them to Anaheim. At a dime store, he bought a roll of copper wire for ten cents. He connected all the dry cells in series and was able to produce a good spark, thus introducing himself to the world of spark communication.

Upon his return to his Long Beach home, Don strung a length of copper wire to a neighbor's home and they began communicating in code. Another neighbor showed Don a 20,000-volt transformer with a spark gap that he was using. This neighbor had a cat that would sit right on the spark during transmissions, barely moving when the 20,000 volts was applied. Watching that operation convinced Don that cats have substantially more than nine lives.

Don's next step was to visit the man who installed stove pipes in Long Beach. That gentleman allowed Don the use of his machinery to cut stove pipes into appropriate lengths to serve as transformer cores. Don then spent the next two months winding his own 20,000-volt transformer. A crank arrangement was built into an apple box which made the winding of the wire around the transformer cores easier. Paraffined paper was placed between the layers of wire.

After completion of the transformer project, Don built a simple homemade receiver. (There was, of course, no source of commercially-made receivers at the time.)

The Bureau of Navigation of the US Department of Commerce had not, in the infant state of radio at that time, arranged examinations for persons to qualify as radio operators, so Don wrote, "I can send and receive five words per minute in code. [Signed] Don C. Wallace." He had the statement notarized for a fee of 25 cents and mailed it to the proper authorities and soon received the call 6OC. John Cook received 6OD, and they went on the air immediately.

John Mead, a buddy of Don's in neighboring Hollywood, was licensed as 6OE in 1912. His rotary spark-gap transmitter had a very high-pitched note, while Don's 6OC station had a medium-pitched note. Everyone tried to have a distinctive note to his signal with the result that it was often possible to recognize a station merely by its "note" even before it officially identified itself.

Don and Mead had switches which would turn the motor driving the rotary spark gap on and off without turning off their transmitters. While this motor was building up speed when it was first turned on or when it was losing speed after being purposely turned off with the transmitter in operation, it would change the pitch of the transmitted signal very significantly; Don can imitate perfectly those variations in signal note even to this day.

At that time, Don constructed an automatic identifier for his station, utilizing a wooden wheel, using brass-headed upholstery tacks and strips of brass on the outer circumference of the wheel to form the dots and dashes, respectively, which were necessary to transmit the call 6OC.

Maritime Operation

PJ, the Marconi Wireless Company station only six miles away in San Pedro, was annoyed with Don for causing interference to commercial traffic. (That station's call letters were soon changed to KPJ to indicate its commercial status.) But KPJ was Don's idol. He rode his bike to the station one day and introduced himself to the station manager, who told him that he would get Don a position as a ship wireless operator providing Don could obtain a commercial operator's license.

All the radio operators' exams were administered in San Francisco, so Don went down to the harbor and talked with the officers of several ships then in port. At six feet, four inches, Don (at age 15) convinced one officer that he could clean the overheads (ceilings) of the ship's rooms without using a ladder, an important point to the ship's owners since using a ladder in a rolling sea was considered a hazardous procedure to be avoided if possible.

Don is shown here in Minnesota in 1924 holding the Hoover Cup which was awarded him by the US Department of Commerce for having the best amateur radio station in the United States during the previous year.

Don was "signed on" as an able-bodied seaman aboard the *S. S. Yale*, a passenger ship bound for San Francisco. There he passed the Second Class operator's examination. Just as today, one could not obtain a First Class Radiotelegraph license without shipboard experience.

Returning to Long Beach, he again visited KPJ where he heard one of the ship operators complaining that he would much rather go to the baseball game than work his shift. Alertly, Don told the Chief Engineer that he could handle the job. The Chief agreed and Don was paid the sum of one dollar.

Incidentally, Poly High School had its own spark station, with a block-long antenna suspended between two 80-foot towers. Guess who was largely responsible for the school having such an installation. Hint: Don Wallace has always been an advocate of *long* and *high* antennas.

Shortly after his experience as a substitute KPJ operator, Don was assigned to one of the Banning Brothers ships operating between Long Beach and Catalina Island. Although it had a rated capacity of 1,000 passengers, the load on the return trips from the island on Sunday evenings and on holiday evenings was more likely to be 2,000 persons. On return voyages, a message had to be transmitted to Long Beach Harbor advising the passenger count and how many passengers wished to use the "Big Red Cars" so that the Pacific Electric Railway would have the proper number of streetcars on hand. It was also mandatory to provide information as to how many passengers wanted taxis. Don handled this traffic without a hitch.

More important than the pay was the fact that he could now claim experience as a commercial operator. Once again Don "overhead-washed" his passage to San Francisco and passed his First Class Radiotelegraph operator's exam with a grade of 99.4 percent.

From that point on, during all vacations from high school, Don signed on as radio operator for ships sailing up and down the Pacific coast, some of which went a considerable distance up the Inside Passage north of Vancouver, B.C., to be completely loaded with cargos of lumber. Don found that he also could work as a longshoreman while the ship was in ports. As a high-school football player, Don wanted to gain more strength, so he would load and unload the ships whenever possible.

Speaking of football players, Don says antennas are like football players: A good big one is better than a good small one.

After graduating from Poly High in 1916, Don entered Hamline University in St. Paul, Minnesota, to study banking and business. His fascination with amateur radio remained as strong as ever, and shortly after his arrival on campus he obtained the permission of the college president to install a ham station. The "Old Main" administration building had a steeple 130 feet high. Don added a 40-foot pole and attached one end of his main antenna. The other end was attached to a church steeple two blocks away. Another antenna extended to the Ladies Hall, a block away, and still another ran to the university library, a mere half-block away. The results from this station were excellent, and Don soon became well known in the Midwest as the "Big Signal," a reputation he has never relinquished.

World War

When the United States

became involved in World War I, Don's friends rushed to join the Army, but Don's allegiance was more to the Navy since he had enjoyed his seagoing adventures. It was announced that Navy recruits living on the west side of the Mississippi River would be assigned to the West Coast, so instead of going to the St. Paul recruiting office, Don journeyed a few miles to Minneapolis on the west side of the river to the Navy recruiting office there. He was told to finish his first year of college so he could be given the rank of Second Class Petty Officer. So it was that after leaving Hamline he was immediately assigned to NPG in San Francisco, the main Navy radio station serving the Pacific Ocean. At that time, it was equipped with 300-kW arc transmitters and 600-foot towers.

Don arrived at NPG and the personnel officer told him to go into the operations room and observe the actions of the First Class Petty Officer who would show him what to do. After an hour of operations, the duty officer said that with an additional hour of instruction in Navy procedures, Don would be ready to operate the station. His code speed had already reached 35 wpm in both the International Morse code and the American Morse code, so when the famous "pink ticket" radio operator licenses became available (providing you could copy without error 30 wpm in International and 25 wpm in American code), he passed the examination without difficulty.

Readers may wonder why some individuals developed expertise in both codes. Part of the explanation for this was that until about 1908 or so, American Morse was the only code in use. When wireless came into existence, operators had to learn International Morse if they wanted to participate in the new method of communications. Thus, they became expert in both codes.

Another factor that increased the number of operators skilled in both codes was that shore stations owned by commercial radio companies such as Marconi Wireless and Radio Marine usually had a "pony wire" using American Morse operating from the station to the downtown Western Union office. Expertise in both codes was required to hold one of these shore station jobs. Even today, Don is equally expert in both codes and uses a special microswitch on his Palomar keyer to send the long dash representing the letter L in American Morse.

Don had a number of interesting experiences while assigned to NPG. On one occasion, the personnel officer reported that he hadn't heard from the lightship stationed 15 miles out from San Francisco Bay for more than a month. Don told him there wasn't a radio ever made that couldn't be repaired and suggested that he be assigned to make the repairs. He was sent out to the lightship on the next supply tug and had the repairs completed in about 90 minutes. When he requested permission to return to shore with the tug, it was denied and he was ordered to remain aboard the lightship for another two weeks.

He used that time to put the ship's five-kilowatt transmitter and all the receiving equipment into first-class condition. Then, noticing that there were no instruction books or manuals for the radio equipment aboard the vessel, he typed a 75-page booklet with service instructions and diagrams. Leaving a copy aboard, he brought the carbon copy of the booklet ashore and turned it over to the personnel officer to be used in case the original was misplaced.

After a quick visit to the Admiral's office, the personnel officer returned to inform Don of his promotion to permanent-grade Chief Petty Officer. He was 19 then and couldn't become a commissioned officer because he was less than 21 years of age.

This photo shows Don's home in Long Beach in 1936 after he had been up all night transmitting pictures to Chicago of the floods and slides which had occurred in the Los Angeles area. Telegraph and telephone lines were inoperative due to the disaster, so amateur radio came to the rescue once again.

Submarines and The President

Don next volunteered for submarine service where he served eight months. The "submarine-qualified" notation on his record added considerably to his Navy paycheck, but at six feet four inches he was just too tall to serve comfortably aboard submarines with their limited overhead clearances. He wanted to return to college as the war wound down, so he requested transfer from the submarine service to a receiver ship and was assigned to the Brooklyn Navy Yard.

An officer there remembered Don's skill as an operator and asked if he knew anything about arc transmitters. He said the Navy was installing a 40-kW transmitter on the Presidential yacht, the *USS George Washington* (which was quite a "yacht" since it was 800 feet long), for President Wilson's use to and from the Peace Conference at Versailles. Apparently, none of the radio operators knew anything about the new transmitters, but Don did, since he had operated

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*FL-52A 500 Hz CW filter (2nd IF)	96.50	89.95
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*FL-44A SSB filter (2nd IF)	159.00	144.95
SM-5 Electret desk microphone	39.00	
HM-10 Mobile scan microphone	39.50	
MB-12 Mobile mount	19.50	
Options also for IC-745 listed below		
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FL-30 SSB filter (passband tuning)	59.50	
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FL-34 5.2 KHz AM filter	49.50	
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SM-6 Desk microphone	39.00	
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CC-1 Adaptor; HF radio to PS-20	10.00	
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IC-25H as above, but 45 watts	389.00	349.95
IC-45A 440 FM xcvr, 10w, TTP mic	399.00	359.95
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EX-248 FM unit	49.50	
SP-4 Remote speaker	24.95	
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IC-3PS Power supply for portables	95.00	89.95
IC-20L 2m amp, 10w PEP or FM	98.00	89.95
IC-30L 432 amp, 10w PEP/FM	105.00	94.95
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IC-4AT with TTP	299.95	239.95

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BC-25U Extra 15-hour wall charger	$10.00
BC-30 1/15-hour drop-in charger for BP-2/3/5	69.00
BP-2* 450 ma, 7.2v 1w ext. time battery	39.50
BP-3 Extra std. 250ma 8.4v 1.5w battery	29.50
BP-4 Alkaline battery case	12.50
BP-5* 450 ma, 10.8v 2.3w hi-power battery	49.50
**BC-30 required to charge BP-2 & BP-5*	
FA-2 Extra 2m flexible antenna	10.00
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CA-5 5/8-wave telescoping 2m antenna	18.95
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and maintained similar equipment on the West Coast where arcs had been developed. Immediately he was put in charge of the radio operation aboard the *George Washington* and he accepted the appointment as Chief Radio Operator for the President of the United States after being persuaded to delay his return to college for a few months.

Don and the 35 operators under his command never missed a schedule with the new equipment. (Among them, incidentally, were Fred Schnell of ARRL fame and Harold Beverage, inventor of the Beverage wire antenna.) Shortly after President Wilson came on board for the trip to France, Don had established 40-kW radiotelephone contact with the Secretary of War, Newton Baker. On his arrival in the radio room to talk with Baker, President Wilson developed a bad case of mike fright and was unable to talk on the air. Don proceeded to talk with Mr. Baker for a few minutes until the President recovered his composure and was able to talk. Can anyone today imagine a President being afraid of a microphone? (After that, the President spent much of his spare time in the radio room.)

In addition to his radio duties, Don was an avid photographer, and he took hundreds of photographs during the trip. In subsequent articles about World War I and President Wilson, many of the photographs published were those taken by Don.

After the first day of negotiations at the Versailles Peace Treaty Conference, messages concerning it were dispatched by President Wilson back to the United States, using the facilities of a French 1,000-kW arc station at Lyon. However, mistakes were made in those first day's messages, so from the second day on, couriers with

Don poses here in 1945 at the entrance of the former receiving station of Press Wireless. Eight commercial radio operators operated 75 receivers daily here to bring the latest news to the Los Angeles Times, *while eight more operators labored at the transmitting facilities of the same firm in nearby Marina Del Rey. Don purchased this building and more than one hundred acres of land from Press Wireless in 1944 and has transformed this boxlike structure into an attractive ham shack with the addition of a peaked roof, landscaping, and porches on both sides of the building.*

locked briefcases handcuffed to their wrists traveled between Versailles and Brest to transport all radio communications to and from the radio room of the *George Washington.* Completing his six-month mission aboard the *George Washington,* Don decided it was time, at last, to return to college.

The Twenties

Don Wallace returned to Hamline—and its football team, which became Northwest champions. He remained in the Naval Reserve since the annual pay was equal to two months of active-duty salary. Transferring to the University of Minnesota after two years at Hamline, he continued to play football on the university's team.

On the faculty there was C. M. Jansky, one of the greatest professors of radio of the time. Since Don was permitted to choose 20 percent elective courses not related to his business major, he decided to enroll in all of Jansky's classes.

The professor was elated to have an experienced radio man in his classes and soon assigned Don to duty at the university's broadcasting station and fine ham station every Wednesday evening. A different student was assigned with him each time and they would stay on the air all night, with Don filling the roles of Chief Engineer, MC, announcer, and program director. He would do live interviews with dignitaries such as the governor of the state, congressmen, and the president of the university. The guests would talk for ten minutes, and then Don played records or commented on the news. This was the first regular broadcasting in the northwest.

When the author of this article began hamming in 1930 in a remote corner of North Dakota, the achievements of Don Wallace were already legendary. Indeed, the November, 1924, issue of *QST* saluted him in a full-page article entitled "Who's Who in Amateur Wireless."

Calls held by Don in Minnesota included 9BU, 9DR, and 9ZT. Next, the Federal Radio Commission issued him 9XAX, which authorized him to operate on any frequency, any time, with any power. The FRC knew it could trust Don not to abuse the carte blanche privileges of such a license.

In 1923, Don was awarded the Hoover Cup for having the best amateur radio station in the United States. (There's no need to worry about the silver plating peeling off the cup with the passage of half a century. There is no plating to peel; the cup is constructed from a solid piece of silver.) When Herbert Hoover became President, the amateur radio signal of W6ZH operated by the late Herbert Hoover, Jr., from the White House, reached westward and sought out and found, on many Tuesdays, the long and high antenna of Don's W6AM.

Don had a part in the original bridging of the Atlantic Ocean by Fred Schnell and John Reinartz. Don's station, then located in the 9th district, was the furthest station worked by Leon DeLoy F8AB.

While Don was still at the University of Minnesota, the General Electric Company let it be known that they wanted a graduate to manage their radio department in Minneapolis. Don took the job and in six months was making more money than the president of the company. Don held that job with General Electric for 4½ years. Among the products he sold were those of the National Radio Company. When National's sales manager, George Hill, offered Don a position covering California and eleven other western states, Don accepted in 30 seconds. The Wallace family moved back to Long Beach, and Don wired his resignation to General Electric.

Also while at Minnesota, Don met Ed Johnson, a mechanical engineering student. Upon graduation, Ed started the E. F. Johnson Company to manufacture radio parts at Waseca, Minnesota. That company be-

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came a very well-known supplier of amateur radio components and transmitters and is still in business today. (It has sold its patents and dies for the manufacture of telegraph sounders and keys to the Nye Company, which still does a brisk business in such items.) Don suggested the original designs of about half of the products that the E. F. Johnson Company manufactured.

When Don came to the West Coast in 1926 to represent the National Radio Company, he wrote to Ed that he would like also to represent the E. F. Johnson Company in the west. Johnson replied that manufacturers' representatives were a "bunch of bums" and that he didn't need a representative to sell his products. Don wrote up a dozen large orders and sent them to Ed with a note that these orders were for old times' sake and their friendship. Johnson filled the orders and sent Don a commission check. Don kept sending orders and Ed kept paying commissions. It wasn't long before Don had the territory officially and on an exclusive basis.

At the height of his career as a manufacturer's rep, Don represented a total of 19 manufacturers of electronic equipment. One account alone brought in a *monthly* commission check of five thousand dollars, and the other 18 accounts also paid substantial commissions. An order usually consisted of a railroad boxcar full of equipment; a half carload was considered to be a small order.

Don secured the two-letter call W6AM in 1926. In those days, the Department of Commerce assigned two-letter calls to amateur operators who also were commercial radio operators. The possession of a two-letter call was, of course, a mark of elitism indicating membership in the "first family" of amateur radio. At that time if you wanted a license for a portable station, a separate license was required, and Don was given the call W6MA to cover that operation.

Some years ago, Don's mobile rig was installed in the convertible pictured here.

From 1926 until 1960, Don traveled extensively throughout twelve western states to call upon his customers. During all of those years, one of the pieces of luggage he carried with him was a "suitcase portable" containing an amateur transmitter and receiver. Arriving at some hotel, he would insist on having a top-floor room. If one was not available, he would move on to another hotel which did have one. After being shown to his room, he would open a window wide so that the drapes would hang outside the building, thus providing an easy means of locating his room from the roof of the hotel where he would suspend his antenna. After dropping the feedline from his antenna to the proper window and returning to his room, Don was soon in communication with his wife, Bertha, at home.

On these occasions, Mrs. Wallace would laboriously transmit code characters by looking at a code chart of International Morse which was under the glass on Don's desk at home. It wasn't long before she asked Don if she couldn't learn Morse, to eliminate that awkward code-chart method. Don's reply was, "Why not, indeed?" and a code-practice schedule of 30 minutes of intensive study daily was begun. Don added a proviso that if the prescribed practice was missed on any day, a *week* of additional practice would be the penalty.

One evening, with the Wallaces all dressed up and ready to leave home to attend a posh party, it was remembered that the practice for that day had not been done. Immediately they went to the ham shack and accomplished the code study necessary even though it meant being a half-hour late for the party.

After two weeks of study, Bertha Wallace passed her amateur radio operator's examination and was assigned W6MA, and Don was told to use W6AM while operating portable in states other than California, followed by a slash bar and the number of the radio district in which he was operating.

Rhombic Farm

By 1938, a radio operator with whom Don had become acquainted during his Navy service, Tony Gerhardt, had become Chief Engineer of a new company called Press Wireless, formed by a group of twelve newspapers to transmit and receive their newspaper stories in order to avoid paying the high rates of the commercial telegraph companies. Gerhardt was charged with the responsibility of selecting a suitable receiving site to operate in conjunction with their transmitting location at Marina Del Rey, and he briefed Don on his problem.

From his earlier residence in the Long Beach area, Don had recognized the highest hill on the Palos Verdes peninsula as a superior location for an antenna farm, but had been unable to persuade the Vanderlip family, which owned 20,000 acres of prime land there, to sell any of it. Told of this, Tony said he had already tried but the Vanderlips still wouldn't sell. Don then reminded Tony that the *Los Angeles Times*, one of the owners of Press Wireless, was very friendly with the Vanderlips, running a full social page on the family every month. Don suggested that Tony contact Norman Chandler, publisher of the *Times*, and ask him to make the proposal to the Vanderlips.

Tony did this, with the result that Kevin Vanderlip agreed to sell Press Wireless a large parcel of land on the very top of the peninsula. Tony, a loyal friend of Don's, purchased all possible equipment needed for the new receiving station from the companies Don represented—including the wire and insulators for the eight 600-foot-long rhombic

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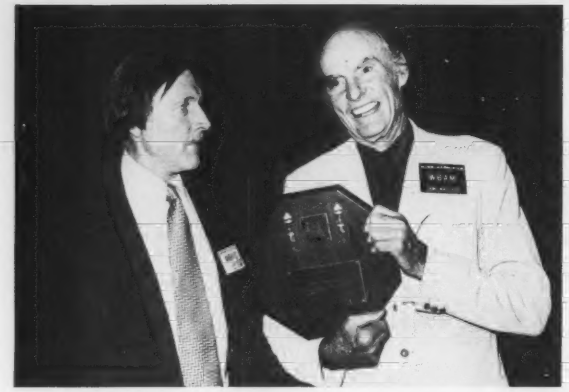

Don is pictured being presented the DX Hall of Fame Award by Lloyd Colvin W6KG at the 1978 National ARRL Convention.

Shown here are the hams, editors, and writers (together with their local guides) from the United States who were guests of the People's Republic of China for a seventeen-day visit to that country in 1980. Don, third from the left, is easily recognizable as the tallest person in the group. The scene is the great bridge which crosses the Yangtze River.

antennas. Later, Don rearranged the antennas and erected nine new 1,000-foot-long rhombics, 140 feet high, which could be fed from either end to fire in eighteen different directions.

At the end of WWII in Europe, the FCC announced that shore stations such as Press Wireless no longer would be permitted to have radio links to their other stations since telephone lines were available. Press Wireless decided to move all its operation to the San Francisco Bay area (where it was headquartered) to eliminate the $32,000 annual telephone bill from the Palos Verdes station. Therefore, they purchased a site near Napa, California, and placed the 120-acre Palos Verdes site on the market in 1944.

Don's offer for the property was accepted, Press Wireless moved its 75 receivers to Napa, and Don moved his amateur equipment to the site, with its 35 major and 75 minor poles.

Since Press Wireless used poles which were only 75 feet high and some stood in valleys between hills, they provided an effective height of less than 75 feet. Don, in accordance with his lifetime policy of using long and high antennas, made 140-foot poles by placing two 75-foot poles butt to butt, securing them together with four 20-foot pieces of heavy four-inch angle iron, with eight heavy bolts through each pole.

Don, who is as spry and alert as a man half his age, has a pair of custom-made shoes constructed especially for the purpose of climbing poles, and he has done the maintenance of his antenna system for many years, although he has had some help recently on the 140-foot poles.

QRO Mobile

Don's super-powered mobile rig (1 kW on low bands; 250 W on 2 meters) had a valuable fringe benefit in addition to providing communications around the world from Don's automobile. Before her death, Don often drove his wife, Bertha, to one of the posh department stores in Long Beach and left her there to shop while he ran his own errands in other parts of the city. After an hour or two, he would return to the vicinity of the store and speak into the mike of his mobile rig as follows: *"Mrs. Don Wallace, will you please come to the front door of the store?"*

The store's PA system, overwhelmed by the powerful signal of W6AM, would always faithfully reproduce Don's announcement loud and clear everywhere within the store, thus saving him the trouble of parking and searching the store for Mrs. Wallace.

While Don's "broadcast" to his wife was intentional, his startling of patrons of Long Beach's State Theatre and of a nearby huge used-car sales was not. Movies were interrupted by, and the car-lot speakers picked up, an occasional "W6AM calling CQ."

Don won the first DX contest sponsored by the ARRL in 1926, and his record as champion DXer of the world is extremely well known. Wallace has talked to radio amateurs in more countries since 1955 than any other ham radio operator: 365 places classified as nations by the ARRL.

"It's like being a world-champion golfer for 25 years or being the world's champion runner for that long," Don says proudly (and deservedly so). He modestly credits his antennas for his DX success.

When the ARRL announced that a $25 plaque was available to amateurs for *each time* they headed the DXCC list, Don sent in his order for whatever number of plaques he was entitled to and asked that he be billed for their cost. However, *QST* determined that Don had headed the DXers list more than sixty times and that the cost of his plaques would be $1775. It asked for confirmation of such a large order before proceeding with it, and Don compromised and ordered only two representative plaques, one for CW and one for phone.

There wouldn't have been room for all of the plaques, anyway, since three of the four walls of Don's thirty- by forty-foot ham shack already are plastered with plaques, cups, and awards for his accomplishments during 72 years of hamming.

When Don twists the knob of the rotary switch which activates the 108 relays to select the rhombic antenna needed to fire a maximum signal to some area of the world, the clicking relays sound a bit like a World War I machine gun nest. Once the proper antenna has been selected, however, all is quiet, and Don is able to work DX stations that other amateurs cannot even hear.

When he is questioned as to how he is able to maintain his position at the top of the DXCC list, he modest-

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ly states that it is not because of his own efforts but those of scores of his friends and fellow DXers who cooperate by advising each other when a new country becomes available. Don says the game is not what many people think. One always helps one's competitors. When Don was vacationing in Palm Springs, one of his DX competitors telephoned him about a new station on Revillagigedo Island. Don drove several hours to get back to his home station, and, thanks to his friend's tip, made the contact for a new country.

Trying his fist in American Morse code at the 1980 meeting of the Southern California Chapter of the Morse Telegraph Club may have brought back memories to Don of operating a five-block-long telegraph line which he and a friend constructed in 1910.

Items

● In October, 1980, Don, along with ten other hams, editors, and writers, was the guest of the People's Republic of China for 17 days of sightseeing and seminars. That made 91 countries visited, and he operated amateur radio in most of them.

● During his lifetime, Don has devised over 100 improvements in amateur radio equipment which have been accepted and manufactured by various companies.

● At least once a year and sometimes as many as four times a year, Don conducts an open house at his Radio Ranch. Radio amateurs with less deluxe stations of their own come to the Palos Verdes peninsula and view with amazement a really superb ham installation. Don is very gracious about accepting requests from ham radio clubs to be their guest speaker and always provides great entertainment.

● When interviewed in the early twenties, Don said, "Amateur radio for me till ninety." He has only five years to go to achieve that goal.

● When interviewed by the *Los Angeles Times* in 1979, Don stated, "Clicking the key and talking to radio hams everywhere in the world is just as exciting to me today as it was when I was a kid."

With that kind of enthusiasm after 72 years of hamming and with a lifetime of extraordinary achievements in wireless and radio behind him, there is only one word adequate to describe Donald Clare Wallace: Superham! ■

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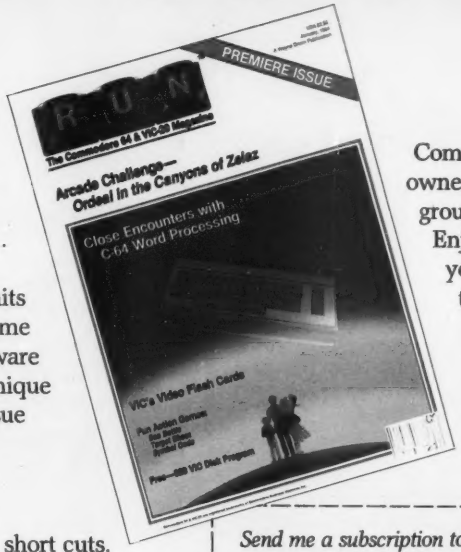

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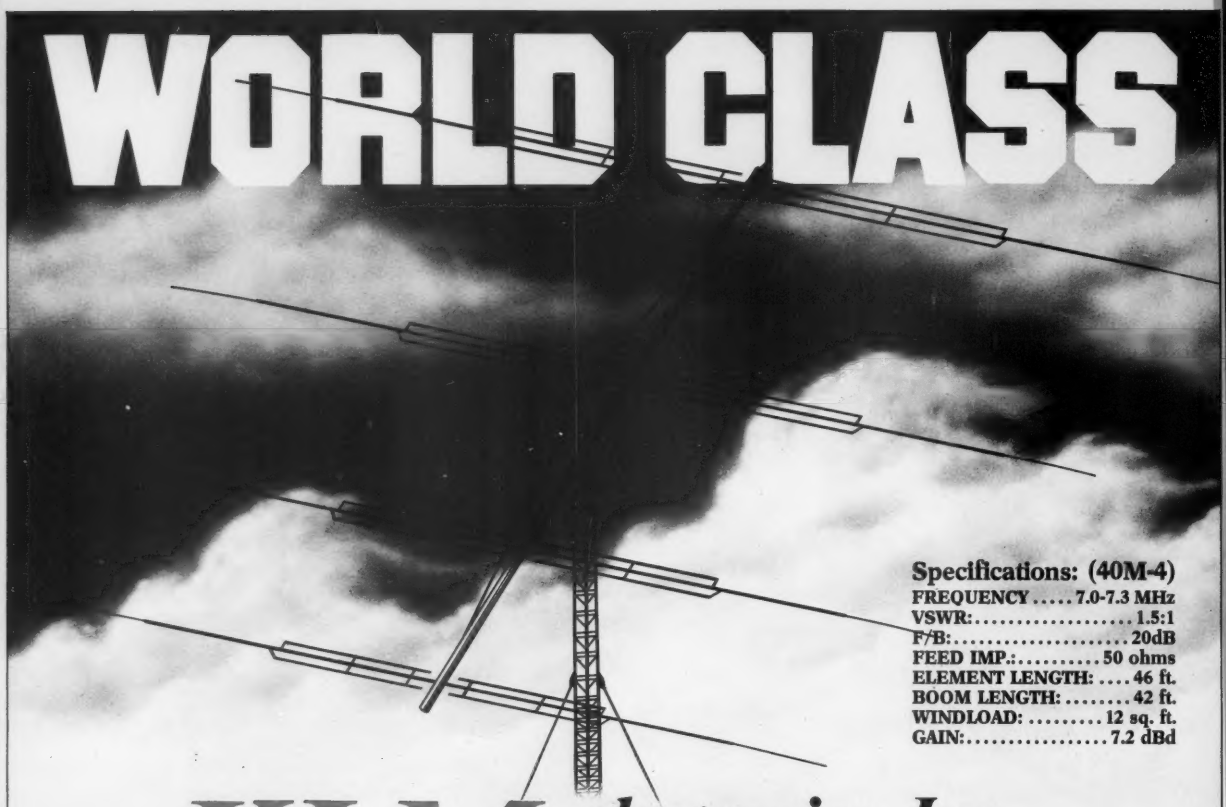

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FREQUENCY ..... 7.0-7.3 MHz
VSWR: 1.5:1
F/B: 20dB
FEED IMP.: ..... 50 ohms
ELEMENT LENGTH: .... 46 ft.
BOOM LENGTH: ..... 42 ft.
WINDLOAD: ..... 12 sq. ft.
GAIN: ..... 7.2 dBd

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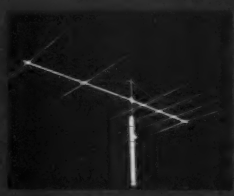

Specifications: (20M-6)
BANDWIDTH: ... 13.9-14.4 MHz
VSWR: 1.5:1
F/B ..... 35 dB
FEED IMP.: ..... 50 ohms
ELEMENT LENGTH: .... 37 ft.
BOOM LENGTH: ..... 57 ft.
WINDLOAD: ..... 12.8 sq. ft.
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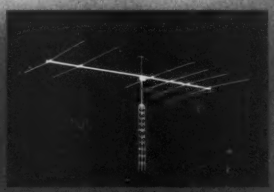

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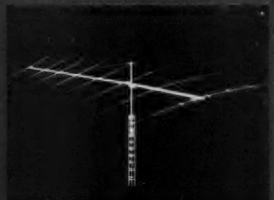
BANDWIDTH: ... 10.1-10.150 MHz
VSWR: 1.5:1
F/B ..... 20 dB
FEED IMP.: .... 50 ohms unbal.
ELEMENT LENGTH: .... 35'6"
BOOM LENGTH: ..... 24'3"
WINDLOAD: ..... 7 sq. ft.
GAIN: ..... 7.0 dB



Specifications: (15M-6)
BANDWIDTH: ... 21.0-21.5 MHz
VSWR: 1.5:1
F/B: ..... 30 dB
FEED IMP.: ..... 50 ohms
ELEMENT LENGTH: .... 25 ft.
BOOM LENGTH: ..... 36 ft.
WINDLOAD: ..... 8.5 sq. ft.
GAIN: ..... 10.5 dBd

Specifications: (7.2/10-30-7LPA)
BANDWIDTH: ..7.2/10-30 MHz
VSWR: ..... 2:1 typical
F/B: 10/15
FEED IMP.: ..... 50 ohm unbal.
ELEMENT LENGTH: .... 46 ft.
BOOM LENGTH ..... 42 ft.
WINDLOAD: ..... 12 sq. ft.
GAIN ..... 3/7 dBd typical

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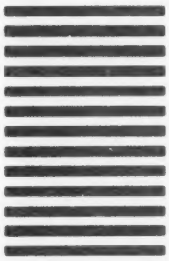

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Courage for Would-Be Hams

Here's the inside story of how a worldwide network of hams is helping handicapped people get their licenses.

Would it surprise you to learn that your next QSO could be with a blind person, someone in a wheelchair, or a man who is allergic to almost everything?

More and more people with physical disabilities are discovering the fun and excitement of making new friends around the world through amateur radio. Among the organizations working to teach disabled people how to become hams is the Courage HANDI-HAM System.

The Courage HANDI-HAM System is an international network of able-bodied and physically-disabled hams dedicated to helping people with handicaps explore their interest in amateur radio and assisting them in obtaining or upgrading their licenses. Headquarters for the system is Courage Center, a United Way-affiliated rehabilitation organization located in the Minneapolis suburb of Golden Valley.

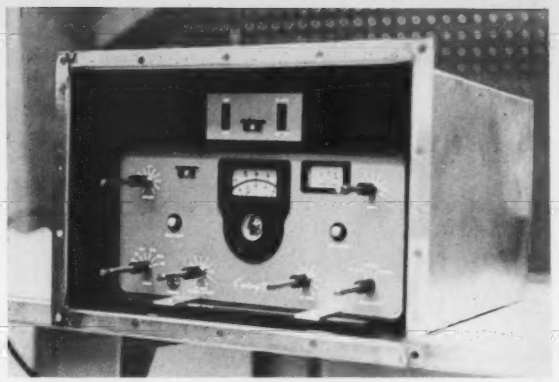
People with physical disabilities interested in amateur radio generally join the system after hearing about it from friends who are hams or reading about it in amateur radio publications. After contacting system headquarters, prospective students are matched with experienced members living in their areas for one-to-one instruction and counseling. Students are also loaned study materials and equipment. In return, they're expected to have a genuine desire to become amateur radio operators and must earn their own licenses.

Once students obtain

Blind HANDI-HAM member, Maureen Pranghofer KFØI, Minneapolis, is a student coordinator for the system. Though she feels amateur radio is an exciting hobby, her guide dog Allen isn't always that thrilled.

Blind HANDI-HAM Dick Eichhorn KBØAE, Minneapolis, is activities coordinator and station manager at the system's headquarters at Courage Center in Golden Valley, Minnesota.

During a typically busy morning at system headquarters, (L to R) John Balkus KØBFU, Minneapolis, and Malcolm Mackay III NØBQC, Minneapolis, check in with the nets while Rex Kiser WØGLU, Edina, Minnesota, "talks" to a hearing-impaired ham on a TTY hooked up to a standard transceiver.



The Courage HANDI-HAM System sealed this Century 21 transceiver into a stainless-steel box so it could easily be used by Bill Savada N5FLY, Falcon Heights, Texas, who is dangerously allergic to the plastic found in most equipment.

their Novice licenses, they can enjoy many other benefits of being HANDI-HAM members: participating in regularly scheduled nets to meet other members, enjoying the fellowship of other hams while improving their skills in contests and "Radio Camps," receiving instruction to upgrade their licenses, and enjoying the satisfaction of introducing other people with physical disabilities to amateur radio.

The Courage HANDI-HAM System was founded by Ned Carmen WØZSW and other interested hams in Rochester, Minnesota, in 1967. Carmen, who had long been fascinated with the idea of organizing a network of handicapped radio operators, finally decided to act on his idea following a thunderstorm watch in Rochester on April 30 of that year.

During the watch, Carmen asked two Catholic sisters in Rochester, Sister Lauren Weinandt WNØRRJ and Sister Judith Simon WNØQVN, to activate their respective stations, "Sky Wave" at St. Mary's Hospital and "The Voice of Assisi" at the Assisi Heights convent, and join in a weather watch.

The watch worked so well that Carmen invited the sisters to help organize the "Minnesota HANDI-HAM System." A 14-member steering committee was formed which met on the air every week to suggest policies and discuss problems. The steering committee soon became the system's board of directors, with a six-member management committee serving as its chief officers.

By the fall of 1967, the system had helped four new Novices receive their licenses. In September of that year, Carmen was honored by the Rochester Chamber of Commerce for teaching amateur radio to homebound people and obtaining equipment and transportation for them. His work also earned him the "Good Neighbor" award, given by WCCO, a clear-channel commercial radio station in Minneapolis. By that time, the system had ten students enrolled.

As time went on, the Minnesota HANDI-HAM System gradually began to make a name for itself. In 1968, the Piconet (Public Information Convenience or Necessity Network) and the Rochester Amateur Radio Club invited the system to co-host their Winter Hamfest. By the summer of 1969, the system made itself known to the nation's amateur radio operators when 26 of its severely disabled members took part in the National ARRL Convention in Des Moines, Iowa.

Sister Alverna McLaughlin WAØSGJ, Minneapolis, Educational Services Coordinator for the system, was a member of the group that attended the convention, and she wrote about the experience in a recent issue of the system's "HANDI-HAM World" newsletter:

"The great HANDI-HAM caravan left for the National ARRL Convention in Des Moines at 7:10 am on Friday, June 20, 1969. . . ten-meter handi-talkies were in each vehicle so we could communicate with each other when necessary. . .

". . . The HANDI-HAM display at the convention was adorned with promotional posters explaining the steps, in pictures, of how a HANDI-HAM member gets his amateur ticket. . . From the comments of the guests who stopped by, we had the nicest booth there. . .

". . . The HANDI-HAM System was the talk of the convention. Hams who were blind pushed wheelchairs and the hams in wheelchairs told the blind people which way to go. . ."

Once the system became known to the amateur radio community, it grew steadily as more able-bodied hams volunteered to be instructors and more people with disabilities eagerly signed on to learn the hobby. Before his untimely death from a heart attack in 1972, Carmen, with the support of several individuals, companies, and organizations throughout Minnesota, expanded his Minnesota HANDI-HAM System into a network of 70 students and 240 disabled and able-bodied members.

To further expand its services and streamline fundraising, the system affiliated itself with Courage Center in 1974. The organization now boasts 3160 members in all 50 states and 27 countries.

But the real story of the Courage HANDI-HAM System is its disabled members who have unlocked the door to a broad new world through amateur radio:

● Hams chewing the rag with Maureen Pranghofer KFØI, Minneapolis, never suspect she's blind, and that's just the way she likes it.

"When people talk to me on my rig, they can't see that I'm blind," says 26-year-old Pranghofer. "Because of this, they're generally more re-

Long-time HANDI-HAM member Jim Mowery KØZWG (left), Fargo, North Dakota, who has cerebral palsy, checks out a rig at headquarters while Dick Eichhorn KBØAE helps out.

laxed and relate to me rather than to my disability."

Pranghofer was introduced to the system when she was a sophomore in high school and was so captivated by ham radio that she earned her Novice license after only two months of intense study.

"I learned my code from braille and memorized it almost overnight," she said. "The electronics theory was tougher because I had to memorize it from tape recordings."

Nowadays, Pranghofer, the proud owner of an Extra-class license, works full-time as a student coordinator for the system, while sharing housework with her husband Paul, a computer analyst who is himself disabled, born without arms and legs.

"I don't get on the air as often as I used to, but I try as often as I can," she says. "Amateur radio is a satisfying hobby for disabled people because it's something they can do that many able-bodied people can't."

She adds that her involvement in the system has rewarded her in many ways.

"The Courage HANDI-HAM System got me started in amateur radio by providing me with the equipment, instruction, and encouragement I needed," she said. "Now that I'm the student coordinator, I enjoy the challenge of turning other disabled people on to ham radio."

● Marlin Gilman WAØAUX has used a wheelchair for over 30 years because of severe arthritis, but that hasn't prevented the 45-year-old Earlham, Iowa, man from making DX contacts in 50 countries.

"Amateur radio has helped me socialize with others and generally become more involved in life," he says.

A next-door neighbor introduced Gilman to amateur radio in 1960, and he has since progressed to his Advanced license, operating a station on his family's farm.

"I'm active on almost every band, and I check in with various nets all day," he says. "I enjoy staying in touch with old friends and making new ones."

But ham radio isn't all fun and games for Gilman, who takes his obligation to public service seriously.

"Back in 1967, Missouri was hit by a heavy snowstorm and cars and trucks were getting stuck left and right," he said. "I helped relay emergency calls to the police from motorists and truckers."

Gilman credits the system with allowing him to join a growing family of disabled and able-bodied hams.

"The people on the air are warm and friendly and I get a big kick out of chewing the rag with hams all over the world," he says. "The Courage HANDI-HAM System has opened a world to me that accepts me for what I can do and ignores what I can't do."

● Amateur radio is even more important to General-class Bill Savada N5FLY, Falcon Heights, Texas, because it helps him ease the isolation of living by himself in a porcelainized stainless-steel trailer located in a sparsely inhabited corner of the state, 60 miles south of Laredo. He can't live in a city, because it would probably kill him.

Savada has universal allergy, which brings on violent, often dangerous, seizures when he's exposed to everyday materials most people take for granted, such as synthetic clothing, cosmetics, plastics, pollen, air and water contaminants, and a host of others.

In 1979, the ARRL put Savada in touch with the system because he faced a tremendous obstacle: He couldn't operate standard radio equipment because he's allergic to the plastic found in most rigs.

System director Bruce Humphrys KØHR, Minneapolis, with the help of several Twin Cities area engineers, companies, and organizations, designed a non-allergenic stainless-steel box with stainless-steel control extentions into which he sealed a standard transceiver. The box was shipped to Savada in March, 1980. Over the phone they agreed that Savada would test his rig by attempting to contact Humphrys at 11:00 am that April 1.

"I was really worried," Humphrys said. "I was worried about whether we'd sealed the box tight enough so Bill wouldn't react to it, worried about whether or not the box had been damaged in transit, and worried about whether or not the rig would overheat and blow up!"

But suddenly, a slow, strong, steady stream of code came over the air. It was Savada, signaling the end of his total isolation.

● The Courage HANDI-HAM system is always looking for new members, either disabled or able-bodied. Able-bodied hams are needed to serve as one-on-one instructors and to help set up rigs and antennas for disabled members.

In addition, people wishing to clean out their basements of old or surplus equipment and parts will find a ready taker in the system, which relies heavily on donated equipment. For information, contact Bruce Humphrys, Director, Courage HANDI-HAM System, 3915 Golden Valley Road, Golden Valley, Minnesota 55422, (612)-588-0811. ■

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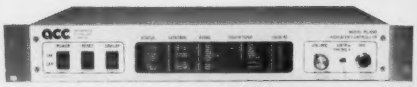

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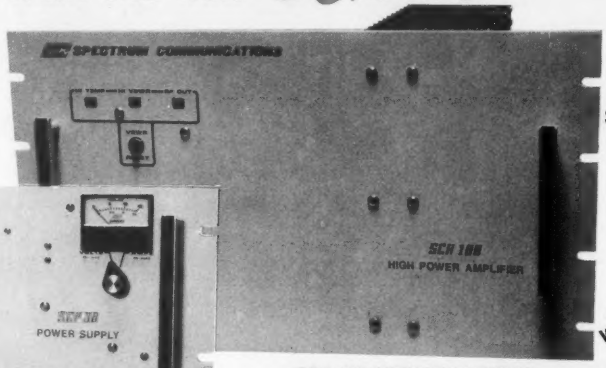
Boost your Repeater or Base Stn.'s Coverage with the new SCA100

100W Amp.

SCP30



SCA100

new

6 Mo. Warranty

The first Amp really designed "from the ground up" for True 100% Duty Cycle!

SCA100 SPECIFICATIONS

Power Output: 100 Watts
RF Input Power for full output: 40W, (SCA100); or 10W, (SCA100-10)
Duty Cycle: 100% Continuous
Frequency Range: 406–512 MHz
Voltage/Current: 13.6VDC nom. 15Atyp. (SCA100)
Size: 10½"H × 19"W Panel. 9" Deep.

The SCA100 100 Watt 440 MHz Power Amp & its companion power supply were specifically designed for absolutely 100% Continuous Repeater or Base Station Duty—i.e., "key-down" for hours, or even months at a time. *It is definitely not just another "mobile amp" bolted to a rack panel!* Both units use the finest quality high power components available, along with very heavy duty mechanical construction.

A massive "deep fin" heat sink is used along with a high efficiency forced air cooling system. This is far more effective than normal convection cooling. Even after hours of key-down operation, the heat sink is only slightly warm! This ensures years of trouble-free operation, even in high ambient temperature areas. Excellent cooling is the key to success for any high power amp, and an area where competitive units are sadly lacking!

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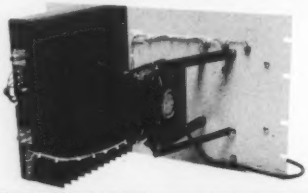
- **Automatic High VSWR Protection**—amp goes to "Bypass" mode for VSWR>3:1, and *automatically "Resets" up to 4 times before latching off*. Prevents needless trips to the repeater site for momentary faults.
- **Automatic Overtemperature Protection**—amp switches to Bypass mode in the unlikely case that it begins to overheat. Autoreset when cool.
- **Automatic Amp Bypass if power supply should fail**—permits "straight through" exciter operation on battery backup power.
- **Reverse DC Voltage Protection**
- **LED Status Indicators** for RF Output, VSWR and Overtemp Shutdown. Front panel VSWR Reset button.



Behind the panel heat sink permits use in secure cabinet with locking front door—*without loss of cooling effectiveness.*

- **RF Bypass Relay** doubles as RF triggered T/R relay for transceiver use.
- **Unusually Tight RF Shielding**—*eliminates very common "stray RF" problems.*
- **Linear Mode Option**—for SSB or AM.

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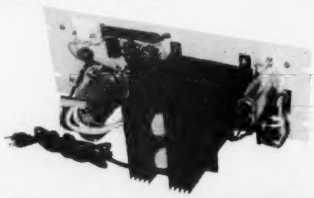
The SCP30 is the companion supply for the SCA100 Amp., but it may be used for any application requiring an extremely heavy duty 25-30A cont. duty supply.

AC Input: 115/230VAC nom. (100–130V on 115V tap.)
DC Output: 13.8V nom.
Max Output Current: 25A (100% Cont.); 30A (Int.)
Regulation NL to FL: 0.8V typ.
Ripple: 100–150mVpp typ.
Metering: Output Voltage & Current
19" Rack Mount. 7" H. 25 lbs.



- **Massive Ferro-resonant Transformer combined with a unique low dissipation regulator** provides excellent regulation and ripple rejection *without the usual high heat dissipation series regulator.*
- **Over-Current Protection Circuit**

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Ron Toller WO4L, ex-KF4EO
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Micro Power for the DXer

This TRS-80 program will help you cure that DXCC fever.

```
                K F 4 E O

15-METER PREFIXES & COUNTRIES:  LAST UPDATE 09/20/82
-------- -------- - ---------  ---- ------ --------

PREFIX:                         COUNTRY:
-------                         --------

3B8                             MAURITIUS
7X4                             ALGERIA
CT2                             AZORES
EA3                             SPAIN
EA6*                            BALEARIC ISLANDS
HB0                             LIECHTENSTEIN
KZ5                             CANAL ZONE
PJ8                             ST. EUSTASIUS
SP9                             POLAND
W/K/N                           UNITED STATES

ZD8                             ASCENSION ISLAND
ZP5*                            PARAGUAY
NUMBER OF COUNTRIES = 12
                              * = UNCONFIRMED
```

Fig. 1. Alphabetical printout by prefix.

```
1 LPRINT CHR$(30):LPRINT CHR$(31)
2 LPRINT TAB(14)"K F 4 E O"
3 LPRINT TAB(14)"- - - -"
4 LPRINT CHR$(30):LPRINT CHR$(128)
5 ' DX-COUNTRY WORKED/CONFIRMED PROGRAM - RON TOLLER KF4EO - 09/20/82
12 LPRINT TAB(12)"15-METER PREFIXES & COUNTRIES:  LAST UPDATE 09/20/82"
13 LPRINT TAB(12)"-------- -------- - ---------  ---- ------ --------"
14 LPRINT CHR$(128):LPRINT CHR$(128)
15 LPRINT TAB(12)"PREFIX:",TAB(42)"COUNTRY:"
16 LPRINT TAB(12)"-------",TAB(42)"--------"
17 LPRINT CHR$(128)
18 LPRINT CHR$(128)
90 CLS:PRINT:PRINT:PRINT:'KF4EO SORT PROGRAM
95 REM CODED BY R. TOLLER - 11/18/80
100 DIM S$(3000),G$(3000)
110 N = 1
120 READ S$(N),G$(N)
130 IF S$(N) = "END" THEN 160
140 N = N + 1
150 GOTO 120
160 N = N - 1
162 PRINT:PRINT:PRINT:PRINT"S T A N D B Y - - - -NOW  SORTING !":FOR BB = 1 TO 3
00 STEP 1:NEXT BB:CLS:PRINT:PRINT
170 FOR K = 1 TO N - 1
180 FOR J = 1 TO N - K
190 IF S$(J) (= S$(J+1) THEN 250
200 X$ = S$(J)
210 S$(J) = S$(J + 1)
220 S$(J + 1) = X$
230 V$=G$(J)
240 G$(J)=G$(J+1)
250 G$(J+1)=V$
260 NEXT J
270 NEXT K
272 L = 1
280 FOR J = 1 TO N
290 LPRINT TAB(12) S$(J),TAB(42) G$(J)
292 L = L + 1
294 IF L) 10 THEN 1000
300 NEXT J
310 PRINT
320 LPRINT TAB(12)"NUMBER OF COUNTRIES ="1N:LPRINT TAB(40)"* = UNCONFIRMED":FOR
CC = 1 TO 500 STEP 1:NEXT CC
325 END
1000 PRINT
1010 FOR AA = 1 TO 1000 STEP 1:NEXT AA
1015 LPRINT CHR$(128)
1020 L = 1
1030 GOTO 300
1100 DATA CT2,AZORES
1111 DATA HB0,LIECHTENSTEIN
1121 DATA PJ0,ST. EUSTASIUS
1122 DATA SP9,POLAND
1130 DATA ZD8,ASCENSION ISLAND
1138 DATA W/K/N,UNITED STATES
1139 DATA EA3,SPAIN
1140 DATA KZ5,CANAL ZONE
1142 DATA 3B8,MAURITIUS
1143 DATA 7X4,ALGERIA
1154 DATA ZP5*,PARAGUAY
1164 DATA EA6*,BALEARIC ISLANDS
10000 DATA "END",X
```

Fig. 2. Program listing, alphabetical sort by prefix.

The active DXer needs a way to monitor a count on his countries both worked and confirmed. The program included here is ideal for a computerized station. The data can be inserted in any order and the sort portion of the program will alphabetize the prefix or the country.

The program is written for a TRS-80, but it can be modified for other computers. The sort portion of the program takes a little time (about 5–6 minutes for 100 countries), but that affords the operator time to make out QSLs or other QSOs while running.

The program as listed is the alphabetical sort by prefix; by changing lines 190 through 250, the program will alphabetize by country.

One thing must be noted: The computer places numbers prior to letters (i.e., 3B8, 7X2, 8P6); in other words, all country prefixes starting with a number will be listed prior to the alphabetical prefix routine.

This and my 2nd op make DX work a pleasure; it also saves time. ■

```
                K F 4 E O

15-METER PREFIXES & COUNTRIES:  LAST UPDATE 09/20/82
-------- -------- - ---------  ---- ------ --------

PREFIX:                         COUNTRY:
-------                         --------

7X4                             ALGERIA
ZD8                             ASCENSION ISLAND
CT2                             AZORES
EA6*                            BALEARIC ISLANDS
KZ5                             CANAL ZONE
HB0                             LIECHTENSTEIN
3B8                             MAURITIUS
ZP5*                            PARAGUAY
SP9                             POLAND
EA3                             SPAIN

PJ0                             ST. EUSTASIUS
W/K/N                           UNITED STATES
NUMBER OF COUNTRIES = 12
                              * = UNCONFIRMED
```

Fig. 3. Alphabetical printout by country.

```
190 IF G$(J) (= G$(J+1) THEN 250
200 X$ = G$(J)
210 G$(J) =G$(J + 1)
220 G$(J + 1) = X$
230 V$=S$(J)
240 S$(J)=S$(J+1)
250 S$(J+1)=V$
```

Fig. 4. Line changes necessary for alphabetical sort by country.

Robert Schlegel N7BH
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Roy WA 98580

Warning: Your Time's Up!

Don't get taken by surprise. This timer add-on will tell you when to ID before it's too late.

Ken Henry's ten-minute-timer design[1] caught my eye as an interesting and worthwhile project. I immediately proceeded to assemble this digital gem and it has been counting out the minutes without a flaw ever since. Although to some a timer may be considered a minor convenience, I find it very helpful in cutting down on the reporting of callsigns. Once in ten minutes is enough!

However, I soon discovered that it is very easy to become overly dependent on the ten-minute alarm. Often I forgot to watch the readout and "timed out" when I could not immediately report my call. Finally, I decided that a warning to draw my attention to an approaching ten-count was a necessity. Fortunately, this proved very easy to do.

Fig. 1, the connection diagram for the 7447/7448 decoder, reveals that a blanking input is available at pin 4. When a low is applied to this pin, all segments of the readout are turned off. Therefore, applying an alternating high-low input to pin 4 will flash the time count and provide a visual warning of an approaching ten-count.

The main problem was to find a logic source to initiate the blanking input at the desired time count. Note, in Fig. 2, that decoder-input D logic is low till the end of the seven-count and then goes high for the last two counts. This high, used in combination with input A logic, can provide a flashing display at the eight- or nine-count as desired.

All that remains is to convert the input D logic source to an alternating high-low at decoder pin 4. This is done easily with a single 7400 NAND gate. As shown in Fig. 3, to obtain a flashing nine-count, pins 1 and 2 of U1A are connected to pin 7 (input A) and pin 6 (input D) of the decoder. At the eight-count, pin 6 goes high. Since pin 7 is low at this time, nothing happens. However, at the nine-count, pin 7 also goes high. With both pins 1 and 2 of U1A high, pin 3 goes low, forcing U1B pin 11 high which in turn is connected to U1C pin 4.

At this point, we need only to provide an alternating high-low logic input to pin 5 and the job is done. Fortunately, the once-per-second pulse at the output of IC2 pin 11 in the timer counter chain provides the perfect source. With U1C pin 4 high, and a high-low input to pin 5, pin 6 will go low and turn off the display once per second.

If you prefer a two-minute warning, connect U1A pin 1 to Vcc with a 2.2k resistor. This holds pin 1 high

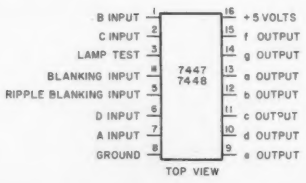

Fig. 1. 7447 or 7448 connection diagram.

	Input
Decimal	D C B A
0	L L L L
1	L L L H
2	L L H L
3	L L H H
4	L H L L
5	L H L H
6	L H H L
7	L H H H
8	H L L L
9	H L L H

Fig. 2. BCD-to-7-segment decoder truth table.

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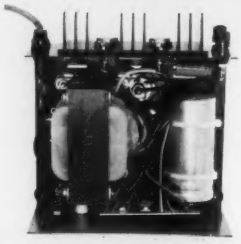

INSIDE VIEW – RS-12A

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MODEL RS-50A

MODEL RS-50M

MODEL VS-50M

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MODEL RM-35A

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Model	Continuous Duty (AMPS)	ICS* (AMPS)	Size (IN) HXWXD	Shipping Wt. (lbs.)
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50

RS-A SERIES

MODEL RS-7A

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W X D	Shipping Wt (lbs)
RS-4A	3	4	3¾ x 6½ x 9	5
RS-7A	5	7	3¾ x 6½ x 9	9
RS-7B	5	7	4 × 7½ × 10¾	10
RS-10A	7.5	10	4 x 7½ x 10¾	11
RS-12A	9	12	4½ x 8 x 9	13
RS-20A	16	20	5 x 9 x 10½	18
RS-35A	25	35	5 x 11 x 11	27
RS-50A	37	50	6 x 13¾ x 11	46

RS-M SERIES

MODEL RS-35M

- Switchable volt and Amp meter

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt (lbs)
RS-12M	9	12	4½ x 8 x 9	13
RS-20M	16	20	5 x 9 x 10½	18
RS-35M	25	35	5 x 11 x 11	27
RS-50M	37	50	6 x 13¾ x 11	46

VS-M SERIES

MODEL VS-20M

- Seperate Volt and Amp Meters
- Output Voltage adjustable from 2-15 volts
- Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H x W x D	Shipping Wt (lbs)
VS-20M	16	9	4	20	5 x 9 x 10½	20
VS-35M	25	15	7	35	5 x 11 x 11	29
VS-50M	37	22	10	50	6 x 13¾ x 11	46

RS-S SERIES

MODEL RS-12S

- Built in speaker

MODEL	Continous Duty (Amps)	ICS* Amps	Size (IN) H x W x D	Shipping Wt (lbs)
RS-7S	5	7	4 x 7½ x 10¾	10
RS-10S	7.5	10	4 x 7½ x 10¾	12
RS-10L(For LTR)	7.5	10	4 × 9 × 13	13
RS-12S	9	12	4½ x 8 x 9	13
RS-20S	16	20	5 x 9 x 10½	18

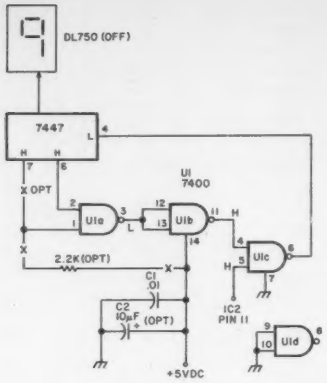

Fig. 3. Schematic diagram of the display flasher. Logic indicated is with display off.

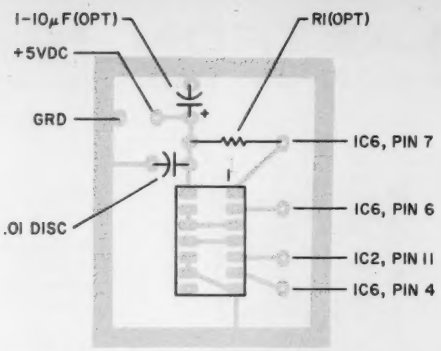

Fig. 4. Foil side of the circuit board and the connection diagram.

so that when pin 2 goes high at an eight-count, flashing action will begin. Pins 9 and 10 are connected to ground, or one pin to Vcc, to force output logic high. Avoid floating inputs on unused gates.

See Fig. 4 for a PC board layout. This circuit is so simple that perfboard is probably more appropriate. Be sure to connect C1 as close to pin 14 as possible. C2 can be any value between 1 and 10 uF and is required only if the power supply is not on the circuit board. Connect C2 at the point on the board where the Vcc lead is attached.

The K3VTQ timer is a terrific project for the aspiring builder. For those of you who do not have a copy of the May, 1977, issue of *73*, an SASE will bring a copy of the original article along with a later article[2] which provides a circuit-board design. ■

References

[1]"Stop Timeouts!", Ken Henry K3VTQ, *73*, May, 1977; "A Three-Digit Timer For TTL Illiterates," Ken Henry K3VTQ, *73*, November, 1979.

[2]"'Stop Timeouts!' Revisited," Kenneth D. Williams WB3ELV, *73*, September, 1978.

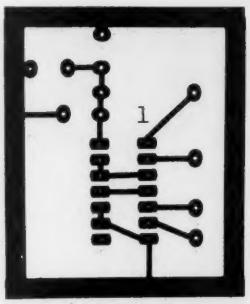

Fig. 5. Circuit board.

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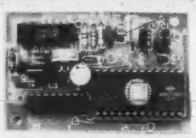

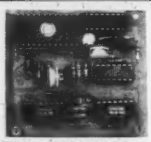

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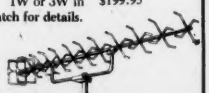

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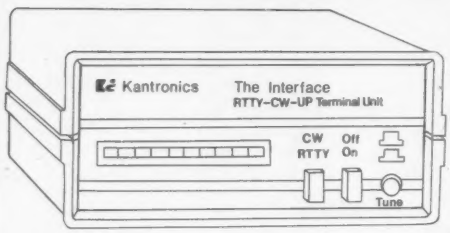

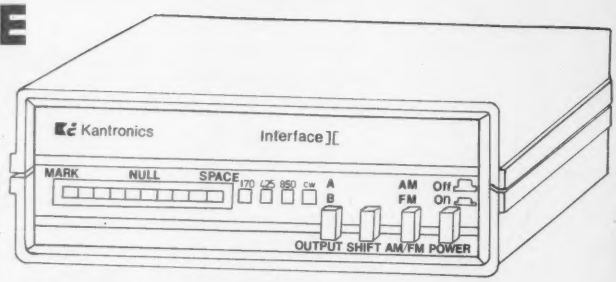

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Hamsoft,™ Hamtext,™ and Amtorsoft™

```
MORSE                    00:00:00
TRANSMIT SPEED   25
RECEIVE SPEED    28
-------------------------------
ENJOY YOUR MEAL AND
WE'LL TALK TO YOU
REAL SOON . . . 73'S . . .
WA5RGU
-------------------------------
WEATHER HERE IS WARM TODAY
WITH LOTS OF SUN. . .XYL SAYS
TIME FOR DINNER SO 73'S W0XI
```

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Suggested Retail **$99.95**

```
                         00:00:00
PROGRAM OPTIONS
A. RETURN TO BASIC
B. EDIT MESSAGE PORTS
C. SAVE MESSAGE PORTS
D. LOAD MESSAGE PORTS
E. SET XMIT BUFF SIZE
F. EDIT HOLDING BUFFER
G. SAVE HOLDING BUFFER
H. LOAD HOLDING BUFFER
I. SET TIME
```

```
                         00:00:00
KANTRONICS AMTORSOFT
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CHOOSE
 S (AMTOR SLAVE)
M (AMTOR MASTER)
 L (AMTOR LISTENER)
 P (PROGRAM OPTIONS)
 T (T/R OPTIONS)
```

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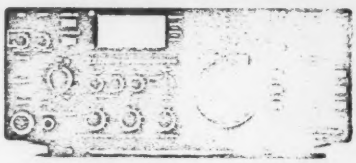

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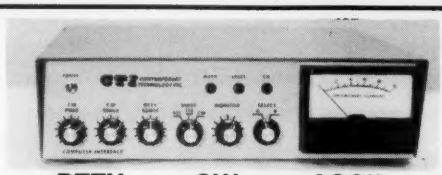

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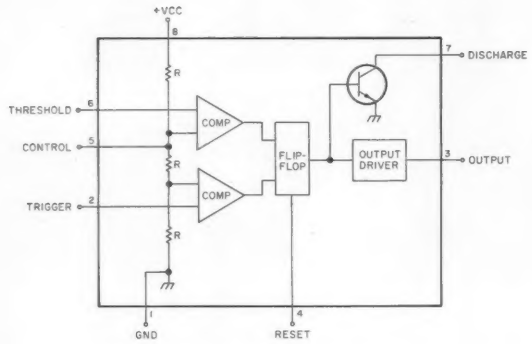

Fig. 1. NE555 timer block diagram.

Many solid-state repeaters nowadays use large lead acid batteries for standby emergency-power sources. One problem that our repeater club had with such a system was that of keeping the battery charged without overcharging it. Keeping a charger on it continuously would have tended to boil the acid out of it after only a short time, rendering the battery useless. Repeated trips up the mountain to replace or refill batteries were out of the question, so a simple regulator was designed to charge the battery when needed and discontinue charging when the battery reached full charge.

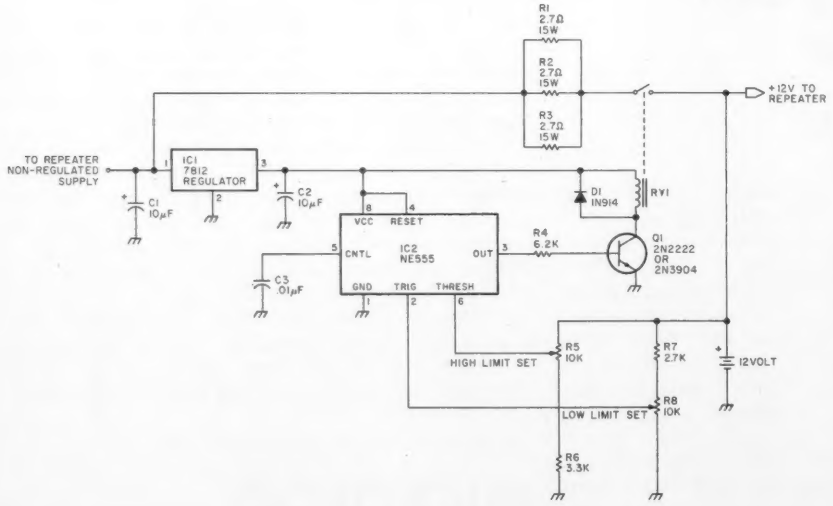

Fig. 2. Regulator schematic.

The Circuit

The key element in this simple circuit is the good ol', ever popular NE555 timer integrated circuit. No, the circuit does not time the charging, but it does make use of the 555's internal voltage comparators.

The block diagram of the 555 is shown in Fig. 1. The 555 has a resistive divider composed of three equal resistances connected between power and ground.

Two comparators are connected to this divider network in such a way as to provide comparisons between ⅓ and ⅔ of the supply voltage. A flip-flop controlled by the comparator's outputs turns on and off the output stage. The output stage is turned on whenever the voltage on the trigger input (pin 2) goes below ⅓ of the supply voltage. Similarly, the output is turned off whenever the voltage on the threshold input (pin 6) goes above ⅔ of the supply voltage. Therefore, to use the 555 as a charger regulator all we have to do is stabilize the supply voltage at 12 volts and scale down the trigger and threshold voltages. The schematic of the simple charger is shown in Fig. 2.

Resistors R7 and R8 form a voltage divider set in such a way that when the battery voltage falls to a lower limit (11 volts in our system), the voltage at pin 2 of the 555 is at ⅓ supply or, in our case, four volts. At this point, the output of the 555 (pin 3) goes high turning on transistor Q1 which in turn activates the charger relay, RY1. This relay connects a charging voltage to the battery through current-limiting resistors R1, R2, and R3. Charging then continues until the battery reaches a high limit (14 volts in our system). Resistors R5 and R6 scale this voltage so that the threshold voltage at pin 6 of the 555 is then at ⅔ of the supply voltage (in our case, eight volts). The output of the 555 then turns off, stopping any further charging. Simple, isn't it?

The unregulated output of our repeater's main power supply is about 16 volts. Since we set our lower charger trip voltage at 11 volts, we had a maximum voltage difference of five volts across the current-limiting resistors. We determined that a charge of around 6 Amps would be adequate. Ohm's law then showed that a resistance of slightly less than 1 Ohm at a power rating of about 30 Watts was needed. Three 2.7-Ohm, 15-Watt resistors from my junk box, wired in parallel, came close enough.

Adjustment

The circuit can easily be preset prior to installation at the repeater site. Connect a variable power supply set to 12 volts in place of the battery and a fixed supply of 14–18 volts to the 7812 regulator. Resistors R5 and R8 should be set to the center of their ranges. Now adjust the variable supply to your desired lower-limit voltage. Adjust R8 to the point where the relay is just activated. Then adjust the power supply to your desired high-limit voltage. Adjust R5 to the point where the relay just falls out. Check it by turning your power supply down to a voltage below your lower trip point. The relay should then pull in and stay energized until you adjust the power supply to a voltage higher than your upper trip point.

Conclusion

This charging circuit has worked flawlessly in our repeater for over a year now. It has shown no signs of rf sensitivity or any kind of malfunction. Although the repeater is remotely switched to battery operation every weekend, water has been added only once. No evidence of significant boilover has been observed. It is a simple circuit that works fine every time. It is just exactly the type of circuit that is needed for a very remotely located repeater.

One caution: Before connecting this circuit to your repeater's main power supply, be sure that the supply can handle both your repeater's maximum current needs and the maximum charging current going to the battery! Otherwise, popped fuses or components can result when the charger is connected. ■

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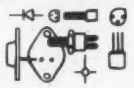

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R5, R8	Potentiometer, 10k Ohm, ¼ Watt	.59	1.18
R6	Resistor, 3.3k Ohm, ¼ Watt	.06	.06
R7	Resistor, 2.7k Ohm, ¼ Watt	.06	.06
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ANTARCTICA

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AS FAR SOUTH AS POSSIBLE

The by-product of an effort to break from the eight-to-five norm was my trip to the south polar ice cap. The assignment was the construction of a 26-mile-long dipole antenna at the National Science Foundation's Siple Station.

Siple Station, located at 76° south latitude and 84° west longitude, conducts upper atmospheric and magnetospheric research. The lengthy dipole is used in conjunction with a 200-kW ULF transmitter and receiver in the study of Whistler-wave phenomena.

Whistler waves occur naturally as a phenomenon associated with distant lightning. The signals follow the Earth's magnetic lines of force, reaching altitudes of several Earth radii while traveling to the opposite hemisphere and often returning on the same path.

The antenna project offered an opportunity to venture over the horizon from Siple Station and travel where no humans had ever been. Because we had the antenna to follow, we were able to work when weather conditions were less than ideal. This provided a chance to witness unique weather.

When the sun was obscured by clouds, the horizon would vanish and the snow's surface would lose all definition. All perspective would be lost. A traveling snow tractor or a fellow worker would appear to float in midair. This condition is known as a whiteout. With a moderate to heavy fall of snow and the associated low visibility, a whiteout would take on a dimension that kept us secured at the station.

During free time, I had the chance to use Siple's amateur-radio station, KC4AAD. A regular schedule for phone patches was attempted using KWM-2A gear. A sloping-V antenna with 562 feet on each leg was used to radiate the signal. The transmitter was located 50 feet beneath the snow in the station proper. The station, built on the surface in 1978, has since been covered by the ever-accumulating snow. It was at Siple that I experienced working my first pileup from the "other end." Now that I've had time to think, I feel that I could have handled it better.

When the antenna project was completed, I was sent further south to work as meteorologist at Amundsen-Scott Station at the South Pole.

The weather at the Pole was extremely cold and quite dull. I never saw the temperature rise above −18° F or fall below −40° F (remember that this was summer). The continuous wind did not rise above 25 miles per hour. There was no snowfall. The air was too cold. Instead, a snow phenomenon known as diamond dust frequently fell from the deep blue sky, faithfully adding to the already phenomenal 9000 feet on the ground. The air had no fragrance, no depth. It was sterile. No birds flew, no wild animals sauntered by; not even bacteria lived outside the station at the South Pole.

I also found time to work the amateur station at the South Pole, KC4AAA. The station's Collins KWM-2A was fed into a six-element tribander up about 75 feet. The antenna's rotor was enclosed in a heated box.

After the phone-patch list was cleaned up (and barring any pileups), I would take time to do what I like to do: rag-chew. The 20-meter band would be searched for some lonely CQ in the night, and I would answer. I think that I received more of a thrill than the other station when I listened to the response of having contacted the South Pole! I also enjoyed armchair contacts with my old friends back home in northern New Hampshire. Once they even patched me into the Granite State FM Net on two meters via the Mount Washington K1OIQ repeater.

I was disappointed that Brian Combs KA3JXR and I did not get to use the controlled-current distribution (CCD) antennas sent to Brian by W4FD and W4ATE as mentioned in the July, 1983, issue of *73*. The powers that be had other plans.

I am looking forward to more fun in the deep south as I have accepted a contract position as radio operator/meteorologist at Siple this season. I may even get a chance to winter-over this year!

References

1. Harry A. Mills W4FD and Gene Brizendine W4ATE, "Antarctic Antennas," *73*, July, 1983.
2. Robert A. Helliwell W6MQG, "Whistler Waves and the Magnetosphere," *The Stanford Engineer*, October, 1982.

AUSTRALIA

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Many countries, to their credit, have had such famous sons as Marconi, Bell, and Morse, whose endeavors in the field of communications are world renowned. Other countries have had their own pioneers in the field of radio communications but they have not received, or perhaps wanted, the world recognition they deserve.

One such person was Alf Traeger, the designer of the Traeger Pedal Radio.

In the year 1907, at the age of 12, he designed his own telephone using the prongs of a pitchfork, two tobacco tins, and some charcoal granules, linking up the farmhouse and an outlying shed. In 1926, at the age of 31, he obtained his amateur license. When John Flynn (the father of the Flying Doctor Service of Australia) was looking for a transceiver that would be cheap and simple to operate on Australia's outback stations and ranches, he contacted Alf Traeger.

After much experimenting, Alf came up with a transceiver that operated on the bicycle-pedal system. It drove a dynamo, thereby leaving the hands free to operate a CW transceiver. This had its drawbacks, as not all people knew Morse code, so, after experimenting, Alf added to his transceiver a keyboard that could transmit Morse letters at a governed speed. And all this back in 1926!

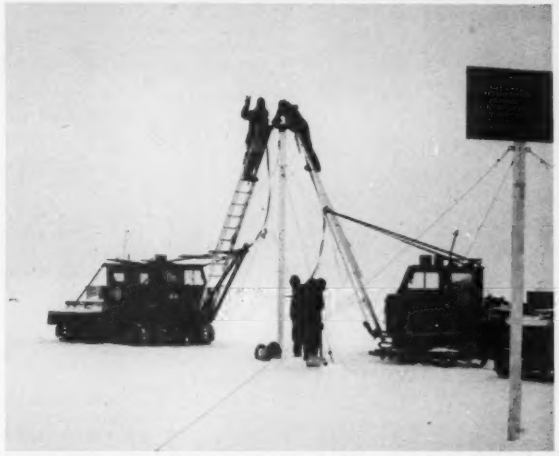
His transceiver was crystal-controlled, and a steady frequency was maintained whether you pedaled hard or slowly. I, for one, spent many tiring hours pedaling away for the station owner's wife or children, while she gossipped or the children got the only education possible for them from a teacher who was 1000 miles or more away.

By 1937, the Morse keyboard was replaced by a radiotelephone system which, while pedaling, left both hands free to either adjust the knobs or swat flies.

Pity the person who was either injured or sick before the advent of Traeger's transceivers. It usually meant a horseback ride of a week or more before help could arrive at some of the remote areas, with the patient either curing himself, suffering pain for a week, or dying. Unfortunately, many people did die. With the advent of Traeger's transceiver and the Flying Doctor, what was once a week's delay in medical help became only hours.

It was not all serious, though; it did have its lighter moments. For example, we had on our station a chap named Andy who had not been home to see his wife for six months. She lived in the nearest town, some 200 miles away. He finally decided to visit her for a get-together. While en route, we sent an on-the-air telegram to her (remember, everybody used to listen to these messages, all over the whole of

Amateur-radio station KC4AAD at Siple Station, Antarctica. Brian Combs KA3JXR is seated at the mike operating DX from "the other end."

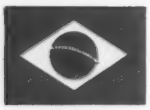


The last connection is made on the 26-mile-long ULF dipole antenna at Siple Station. Four thousand feet of salt-free ice (accumulated snow) beneath the antenna provides insulation from earth ground.

outback Australia). The text was "Coming home, feeling randy, hope you're the same. Love, Andy." He wondered why his reception at home after six months away was less than cool, until he was told of the prank.

With mates like us, who needed enemies?

Perhaps there is still a place today for the concept of pedal radio. Where there is no domestic power, flat batteries would be a thing of the past. How many DXpeditions have failed through generator failure in remote areas? If they took along a set of pedals with an efficient beam, they could still operate as all the Australian outback did, way back in 1926, thanks to Alf Traeger's Pedal Radio.



BRAZIL

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Brazil

CW AWARDS

Since March, 1975, when the Brazilian CW Picapau Carioca Group (Carioca Woodpeckers Group) commemorated its tenth anniversary, a sweeping awards program has been offered to the world's radio amateurs. This was the first group created in Brazil, and it is now 18 years old.

Well-balanced rules for DX participants and an interesting program for Brazilian hams brought such great participation that a TRS-80 Color Computer has been brought into use to handle the whole business, including the PPC Hunters Club, an exciting competition developing extraordinary interest among Brazilian radio amateurs.

Special care is taken for DX operators, so it will be easy to find PPC members operating all DX bands. Quick delivery of QSLs and awards are considered important "musts" by the group.

Members are PP1IR(B&P), PY1AFA, PY1AN, PY1ARS, PY1AVV, PY1AYE, PY1BLG, PY1BOA, PY1BUL(YL), PY1BVY, PY1CBW, PY1CC, PY1CCE, PY1DFS, PY7CGV(YL), PY1CIP, PY1CKV, PY1CTP, PY4CZ, PY1DFF, PY2DHP(YL), PY1DMZ, PY1DUB, PY1DUJ(YL), PY1EIR, PT9EJ, PY1ETP, PY1ETY, PY2EW, PY1EWN, PY2FWR, PY2FWT(B&P), PY6HL, PY1HQ, PY4PZ, PY1RJ, PY1SJ(YL), PY1SW, PY1VB, PY1WA, PY1WDS, PY1TG, PY1AAU, PY1DMX, PY1EBK, and PY1DGB. We are very happy to invite you all to join the fun of the PPC CW awards program!

PPCAW—Work five stations of PPC members.

PPCDX—Work 50 stations, suffixes forming international prefixes, according to the ARRL list, e.g., WA2*PY*, SM1*LU*, UK2*VE*, using only two-letter suffixes. To form one-letter prefixes, use one, two, or three *same*-letter suffixes, e.g., KA4*F*, G3*FF*, or PY5*FFF*. Maximum of ten stations from the same country (except if from Brazil, where there are no limits). Endorsements or credits for each new 10 stations, until 100 total stations.

PPCPY—Work 27 different stations with two-letter suffixes which are the same as Brazil's 27 states' two letters: AC, AL, AM, AP, BA, CE, DF, ES, FN, GO, MA, MG, MS, MT, PA, PB, PE, PI, PR, RJ, RN, RO, RR, RS, SC, SE, and SP. Maximum of 6 stations with the same prefix, except for no limits with Brazilian station QSOs.

PPXA—Work 50 different prefixes from North, Central, or South America. Credits for each new 50 prefixes until you reach a total of 300 stations.

PPQRA—Work 17 different stations using suffix's first letters to form: P-P-C P-I-C-A-P-A-U C-A-R-I-O-C-A. Credits for same task but using second suffix letters and third suffix letters.

PPC3A—Work 25 countries in North, Central, and South America, ARRL list. Any band, but 3 Americas must be represented for the basic award. Credit for each new 10 countries in North, Central, or South America.

5BPPC—Work five different Brazilian prefixes on each of 5 bands, 10–15–20–40–80/160, and one PPC member per band. If it is in the same claimed band, the PPC QSL is valid for that task, too. The basic award is obtained for any complete band and PPC QSL. Same prefixes can be worked in other bands if different stations. Contacts valid only after 01-01-81 for 5BPPC.

QSOs since March 22, 1975, are valid for all awards except 5BPPC. No QSLs needed; just send logs signed by your radio association or two radio amateurs. Send GCR list indicating number, call, date, and declaration that all QSOs were two-way CW signed by association or two radio amateurs; include one of your QSL cards for PPC files.

GCR, log, and a 5-IRC fee for each award must be sent to PPC Award Manager, PO Box 18003, Rio de Janeiro, RJ 20781, Brazil.

For credits, send an SASE and 1 IRC.

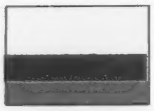
CANADA

CARF News Service

Keeping a radio-station log is no longer necessary, except for Amateur-class operators who will need logs and QSL cards for proof of operation when applying for 10-meter and VHF phone privileges. DOC promulgated the change on June 22. Another change in the regulations made at the same time makes it easier for those with Amateur-grade certificates who live far from exam centers to obtain authorization for Advanced-class privileges, good for one year. Logs and QSL cards are also required when applying for this permission. Minor changes have also been made to the titles of the various Certificates of Proficiency.

DOC soon will ask for public comments on special considerations to be written into the regulations for handicapped candidates for exams. Also up for comment will be a change to require candidates for the Advanced-certificate code test to know figures and punctuation marks. At present, these are required only for the Amateur-class test. Comment will also be asked on a proposal to drop licensing of scanning receivers, a requirement which has proven practically unenforceable.

Good news for those plagued with power-line and appliance interference. DOC plans to proceed with regulations governing rf noise from these sources. Other regulations to cut the interference from electronic appliances, computers, and games are now being drafted by the Department. The regs will include what is termed "digital apparatus" and will be aimed at preventing dumping into Canada equipment which can't meet US standards.



COLOMBIA

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Colombia

NEW RADIO-AMATEUR RULES

The Colombian government, through the Ministry of Communications, has issued new radio-amateur rules which will be implemented in the coming months. They include some specific norms for the use of amateur satellites emphasizing the technical and experimental aspects of this service, in accordance with the international regulations.

Regarding radio-amateur licenses, they will be issued to hams from the age of fourteen: Novice; Third class, after holding a Novice license for one year; Second class, after one year of holding Third class; and, finally, First class to those hams having held a Second-class license for a minimum of two years and passed a stringent examination.

First- and Second-class licenses are permanent, while those below must be renewed every four and two years, respectively. Callsigns must be used at the beginning and at the end of each transmission.

One of the most interesting aspects of the new regulations relates to nationals holding foreign licenses. They can obtain a Colombian radio-amateur license without having to pass any tests. Besides, the Colombian license will be of equal category to the foreign one.

As for foreigners residing or visiting the country, their valid license will automatically be honored by the Colombian Ministry of Communications with the same category and privileges without having to submit to examination, and they will retain their own callsign followed by the HK prefix plus the number of the zone from which they are operating. A consular certification from the country of origin is required by the Ministry of Communications for the issuance of the permit.

There are nine amateur zones in Colombia, namely, HK0 for the islands and maritime-mobile operation; HK1 for the Atlantico, Bolivar, Cordoba, and Sucre provinces (Departamentos); HK2 for the Guajira, Magdalena, Cesar, and Norte de Santander Departamentos; HK3 for Cundimamarca (this includes Bogota), Meta, and the Vichada Commissary (Comisaria); HK4 for the Antioquia and Choco Departamentos; HK5 for the Departamentos of Valle del Cauca and Cauca; HK6 for Caldas, Tolima, Huila, Quindio, and Risaralda; HK7 for Santander, Boyaca, and the Intendencia of Arauca and Casanare; HK8 for Narino, Caqueta, and the Intendencia of Putumayo, and HK9 for Comisarias of the Amazonas (the southernmost tip of Colombia bordering Brazil and Peru), Vaupes, Guainia, and Guaviare.

If a holder of a valid radio-amateur license is dead, any one of his relatives can keep the license provided he/she passes the tests and other requisites within one year of the original holder's death.

To operate a ham-radio station, there is also a new requisite besides holding a valid radio-amateur's license, in the form of a contract signed with the Ministry of Communications and the payment of a small tax. The contract is valid for periods of two years for Novice licensees, four years for Third class, and five years for those with First- and Second-class tickets, renewable for equal periods of time.

The use of phone-patch traffic continues to be prohibited except in emergency situations and for special cases involving communications from the so-called "National Territories" which are those sparsely-populated areas bordering Venezuela, Brazil, Panama, and Peru.

Finally, and most encouraging, is the proviso whereby the Ministry of Communications from now on will issue special honorific certifications (diplomas) and decorations to those radio amateurs (Colombian or otherwise) who have rendered special and distinguished (outstanding) services for the benefit of the community and humanity.

CYPRUS

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Cyprus

THE CYPRUS AWARD

The Cyprus Award is being sponsored by the Cyprus Amateur Radio Society. It will be awarded to any licensed amateur-radio operator outside Cyprus who makes a specified number of two-way contacts with licensed amateurs on Cyprus.

To reduce as far as possible any advantage accruing to stations because of their geographical location and to encourage activity on the less frequently used bands, the certificate will be awarded on a points basis deteremined by the zone location of the station and the frequency bands used. This is shown in the table.

The total number of points required to win the award is dependent on the number of bands used:

If all contacts are made on only one band, 32 points are required.

If the contacts are made on any two bands, 24 points are required.

If the contacts are made on any three bands, 16 points are required.

If the contacts are made on any four bands, 12 points are required.

Any mode of emission may be used, but operation must be in accordance with standard amateur-service practice. Contacts must be made after April 1, 1973. A certificate awarded for contacts made in the VHF bands will be suitably inscribed. Contacts with any one Cyprus station can count only once per band.

Points per contact, by band (in MHz)

	1.8	3.5	7	14	21	28	144	432
CQ Zone								
20	8	2	1	1	2	4	2	8
1, 2, 3, 6, 7, 10, 12, 19, 24, 25, 26, 27, 28, 29, 30, 31, 32	16	8	4	2	4	8	-	-
All Others	8	4	2	1	2	4	16	32

Cyprus Award points schedule.

To claim the award, copies of log entries with the following information should be submitted: date/time GMT, station worked, frequency band, and signal reports in and out. Each log sheet should be headed with the callsign, zone number, and full postal address, preferably typed or printed in block letters. These should be supported by the appropriate QSL cards or a certificate from the applicant's national society certifying that the QSL cards have been made available to them. In countries without a national society, a similar certificate signed by two other amateurs will suffice.

Log sheets accompanied by ten IRCs or US$2 or the equivalent should be sent to the Awards Manager, Cyprus Amateur Radio Society, PO Box 1267, Limassol, Cyprus.

The log entries will be checked and, at the discretion of the Cyprus Amateur Radio Society, the certificate will be awarded. Unsuccessful applicants will be notified of the reason for rejecting their claim.

DOMINICAN REPUBLIC

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Santo Domingo
Dominican Republic

Greetings from the Dominican Republic to all the readers of *73*. From now on we will cover interesting news concerning ham radio in this beautiful island in the Caribbean.

We will also be glad to help you in getting any HI QSL which you have failed to receive, work out a schedule for a particular band, or answer any of your questions pertaining to the ham scene here.

The Dominican Republic (HI) shares the Hispaniola Island with Haiti (HH) in the Caribbean Sea between Puerto Rico and Cuba. The Dominican Republic has a territory of 48,442 km^2 and Haiti has about 26,700 km^2. The capital city of the Dominican Republic is Santo Domingo; it holds one and a half million people of the total population of six million.

The country is divided into nine zones for ham-radio purposes. Zone 1 includes the islands of Beata and Alto Velo, which belong to the Dominican Republic, and some islets in the surrounding area. Zone 2 includes three islands, Saona, Catalina, and Catalinita. These first two zones are activated only in DXpeditions since they have no permanent ham-radio residents.

The first DXpedition to Beata Island (HI1RCD) was in 1979; it was run by a group from the Radio Club Dominicano. Zone HI2 was activated for the first time on Saona Island in 1977 by another group from the above-mentioned club. Later, in the years of 1980 and 1981, some DXpeditions were also made to Catalina Island, again by the boys of the Radio Club Dominicano.

The northern and central areas of the country correspond to Zone 3. At the present time, there are well-organized and very enthusiastic ham-radio operators among the Zone 3 members of the Radio Club Dominicano. They are very active on 2 meters and also on the other bands. There's great enthusiasm for DX and contests. Right now, we could state that this zone is the most active in ham radio in the Dominican Republic, having around 100 active ham operators.

Zone 4 holds only two active operators, while there's only one in Zone 5.

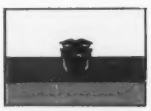
In the beautiful seashore area of the southwestern part of the country, in Palmar de Ocoa (which is included in Zone 6), we have Arturo HI8GB/6. He operates from his beach house during weekends. Arturo is a true DXer who speaks fluent English and also enjoys contests.

The eastern part of the country is Zone 7. Here we can find from 10 to 15 active ham-radio operators.

Zone 8 corresponds to the capital city which, as you would expect, holds the greatest number of ham operators even though the active ones number no more than 125. And Zone 9 contains only two operators, mostly active on 40 meters.

As it is clearly shown, the total number of active ham-radio operators in the Dominican Republic is close to 250, regardless of the 1500 or more that are listed in the *Callbook*. Due to this fact, HI is still considered good DX, especially on the 10-, 40-, 80-, 160-, and 6-meter bands, and it will be our purpose on these pages to keep you up to date with interesting information on when and how to make your contacts with HI in the different zones and on the bands that are more uncommon.

There is much more to come, but that will be in future columns from the Dominican Republic—the best well-kept secret of the Caribbean!



ECUADOR

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Ecuador

Here is the inside view of what happened at the recent meeting in Cali (Colombia), attended by our delegate, Gustavo Crespo HC2NW. The sponsor was the Cali branch of Liga Colombiana de Radioaficionados and the meeting took place on the 50th anniversary of the foundation of the Liga.

On the first day, June 6, the five work committees were formed. Ecuador took part as secretary of the "VHF/UHF Satellites Commission." The meeting was held in CIAT, the Centro Internacional de Agricultura Tropical, and it was superb. There were simultaneous translations for all of the participants.

The commission in which Ecuador took part came up with the following:

- Frequency assignations in the new bands, and a compromise between governments which would allow radio amateurs to use the new allocations shortly.
- The procedure of issuing licenses should be standardized and the delegates will work toward that goal.
- It was decided that July 1, 1989, will be the deadline for governments to open up the new allocations.
- Peru proposed outlines of how to use the new segments.

We should note here that most of the time, the decisions were unanimous.

A committee member from Japan gave a talk about the launching of the new JAS-1 satellite at the beginning of 1984 and explained how the funds were raised. One-third were donated by Japanese amateurs and the difference came from the government of Japan.

The committee also recommended that amateurs should give their QTH as standard calling procedure. If it is approved, we will say, for example, "This is HC2PP, latitude XX, longitude XX." It is a good idea, but it will take a while to catch on.

On the last night of the meeting, the Ministry of Communications gave away 500,000 postal stamps worth 12 Colombian pesos each, to commemorate the meeting of the IARU.

These highlights are a few words reflecting 800 pages worth of decisions at the meeting. The organization was fantastic, and there was always an HK radio amateur with every member or delegation.

FRANCE

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France

If you travel in France . . . try the 2-meter repeaters!

First of all, you have to ask for a French license. For this, apply to: DTRE-CGRP Service Radio-Amateur, 94002 Creteil (Cedex), France; phone (1)-569-96-20.

All of the information you need for a license will be sent to you. Don't forget, you have to submit your application early if you want to enjoy your FØ callsign.

Repeaters are very good companions for a trip in a foreign country. They can be very useful, too. At the very least, put an HT in your pocket and bring it along. Of course, it is better to have a car mounted with a 5/8-wave and 25 Watts (but keep customs in mind and have your bill of sale).

About 30 two-meter repeaters are located in "the Hexagon." They are in the upper part of the VHF band (144–146 MHz). Fifteen channels are scheduled, a little bit more than the IARU band plan calls for. To open a repeater, a 1750-Hz tone burst is required (you can also whistle). However, this tone burst is not necessary during the QSO. The time remaining after sending your callsign is sufficient. Transmit after the "K." Repeaters can be anti-chatter-protected. FZ1THF, for example, has a one-minute limit; it is very busy . . .

Some repeaters, such as F27THF, are equipped with voice synthesizers.

The shift is 600 kHz down, with a 25-kHz step between channels. Autopatch is not allowed, but on Tuesday evenings RTTY and SSTV are authorized.

Some home-brew equipment is heard on the air, but more often Icom, Kenwood, and Yaesu HTs are becoming popular for hikers and walkers.

Unfortunately, we also have intruders from time to time. They are called "Shaddock," from a famous cartoon on French TV.

Generally, few QSL cards are exchanged, except for FØ.

Between repeaters, there is no QRM when normal VHF propagation occurs. The purpose here is to have a low density of machines. Eventually, you may have the opportunity of using some simplex channels, such as 145.500, .525, .550, and .575.

English is not the mother language here, so contacts will be easier if you speak French—even a little. And while using other languages, speak slowly!

ITALY

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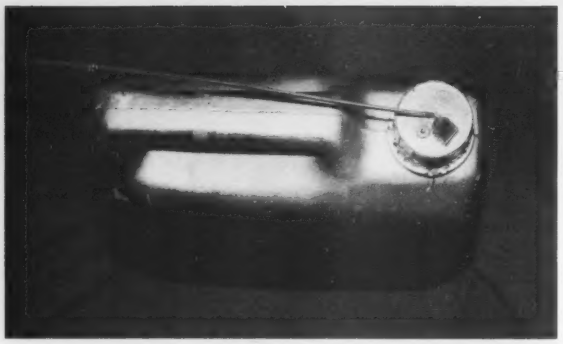
Italy

The Italian QSL bureau has been reorganized and is now working at full speed. There is no backlog at the end of each month and the transit times have been substantially reduced. Cards are sorted by callsign at the QSL bureau and are bundled and shipped to the local radio clubs. In each of the clubs there is a manager responsible for local distribution.

Each member of the club has a box where he can find the incoming cards once a week during the meetings. There are about 200 of those clubs all around the

Channel	Call	QRG	Dept.	QTH near:
R0	FZ1THF	145.600	92	Paris
	FZ3VHF		22	Saint-Brieuc
R1	FZ6THF	145.625	68	Colmar
	FZ7VHF		89	Auxerre
R2	FZ4VHF	145.650	87	Limoges
	FZ9VHB		84	Avignon
	FZ1VHB		77	Provins
R3	FZ8VHF	145.675	69	Lyon
	FZ9MCA		06	Monaco
R4	FZ3THF	145.700	61	Alencon
	FZ4THF		64	Pau
R5	FZ4VHB	145.725	33	Bordeaux
	HB9G		-	(Franco-Suisse) Geneve
R6	FZ2THF	145.750	80	Peronne
	FZ5VHF		81	Albi
R7	FZ3VHB	145.775	85	Cholet
	FZ7THF		39	Dole
	FZ9THF		13	Marseille
R8Bis	FZ2VHB	145.325	14	Caen
	FZ9VHF		66	Perpignan
R9Bis	FZ1VHF	145.350	27	Vernon
	FC1VHF		20N	Bastia
	FZ8VHB		73	Chambery
R10	FZØTHF	145.375	37	Tours
	FZ6VHB		67	Strasbourg
	FZ5VHB		48	Mende
R11	FZ2VHF	145.400	20S	Ajaccio
R12	FZ5THF	145.425	09	Foix
	FZ6THF		51	Chalon sur Marne
R13	FZ9VHC	145.450	04	Digne
R14	FZØTHF	145.475	63	Clermont-Ferrand

French 2m repeaters.



The oil-container transmitter case with antenna.

country; if you do not belong to one of them, you can have direct mail service to your address.

The biggest club is in Milano (more than 600 members). It is made up of a few rooms in a school building and has a conference room to accommodate all the members. The QSL service is now very fast, and from some random tests we have verified that it can take 3 or 4 months to receive a card from the moment you mail it to your bureau. But this is valid only if your correspondent does send you his card, which does not happen very frequently with US amateurs.

During the month of June, we had in Italy the first "League Clubs Contest." The participation was incredible in spite of the fact that this was the first edition. Being the contest manager, I was surprised to receive more than 3 feet of logs from 300 out of the 600 participants.

It has been a national contest and it will remain like that in 1984, but it could become international in 1985. The next contest will have an Icom HF transceiver as first prize and a VHF one as second prize. In the meantime, we will start a contest for SWLs that will have a general-coverage receiver for the top scorer.

A new award has been introduced by the ARI DX Blue Team—the IIA (Italian Islands Award). You need 10 points for it and you can get them by contacting stations in the Italian islands. It's easy to recognize them from the prefixes: IA1, IA5, IB0, IC8, ID9, IE9, IF9, IG9, IH9, IJ7, IL7, IM0, IS0, and IT9.

Islands with a local resident ham count 1 point; islands with no local resident ham count 3 points or 2 points (according to a long list that I can provide to anybody who needs it).

You can contact the same island on different bands and modes. There is an honor roll at 60 points and a 5-band endorsement for working 10 islands on 5 different bands. No need to send cards.

The cost is $8. The award is in full color on special paper and features an old map of Italy showing all the groups. All requests should be sent to ARI, Via Scarlatti 31, 20124 Milano, Italy, or to my address.

GREECE

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Greece

Repeater R1 at the top of Mount Parnis has been the target of some people for quite some time now. It is the most active repeater, especially during long weekends and holidays. A few days before Easter this year, a steady signal was at the input of the repeater, disturbing its normal use. After four consecutive days of night-only transmissions, we figured that the new beacon placed had a timing device that permitted it to work every evening. This made it difficult to trace, compared with the other two jamming beacons that had been on continuously in broad daylight.

The four 19-element yagis of SV1OE gave us an indication that the bug was placed close to the mountain. With fingers crossed, SV1NN, SV1NK, SV1RJ, SV1RP, and I started the fox hunt. SV1RJ borrowed a wooden broom handle that was converted to a 4-element yagi of his own construction—with fine results. The small convoy of three cars stopped at the parking lot at the foot of Mount Parnis. No signal was heard on our FM rigs and no signal was received by the SSB rig on our vertical.

We unpacked the "broom-yagi" antenna and there it was. A small signal appeared when the antenna was pointed to the casino/hotel at the top of the mountain. Enthusiasm made us forget the low temperature and gave us the courage to continue. Close to the top of the mountain and three kilometers before the casino, a strong signal blocked our receivers. As we got closer to the casino, the signal was weak so we decided to return to the earlier point. Strong indications again, but we could not pinpoint the bug.

A Yaesu FT-290 and an Icom IC-2E were in use at the time. By midnight, we were circling 200 square meters of a mountain with trees and rocks. The signal was strong with no antenna, but the rf was reflected by the trees, which made things difficult. The broom-beam worked again and gave us two indications. After walking some 30 meters on the road, we found the bug at the base of a tree.

It was a very sophisticated device contained inside a 4-liter motor-oil can. (See photos.) The antenna was on the outside with a photo-resistor that permitted it to operate only at night.

Authorities were not in a position to handle the matter at the time, so following the instructions of the president of our association, we removed it. After a good exam at my lab for fingerprints, it was forwarded to RAAG and placed with the other two beacons. The whole construction was made on a 3 × 5 cm PC board which had a 72.338 crystal. Ten D-size batteries in series powered the beacon, which drained 25 mA when in operation and 70 uA when off the air.

GREAT BRITAIN

Jeff Maynard G4EJA
10 Churchfields
Widnes WA8 9RP
Cheshire
England

THE UK SCENE

I am finding writing this just a little difficult having returned only yesterday from a holiday in HB9 (Switzerland). It's not jet lag that is the problem (it being only a one and a half hour flight), but rather the general lethargy that sets in when the sun is hot and the beer cold!

All Swiss people are nice, and the small population of radio amateurs particularly so. The mountainous terrain of Switzerland makes local communications difficult and provides a perfect setting for a network of 2m repeaters. Most of the peaks have skiing centers with access via chairlifts and power supplies, so it is relatively easy to site a repeater in a good location.

I did not this trip apply for a reciprocal license largely because I did not wish to take any equipment with me. In retrospect, the 30 Sfr fee (about US$15) would have been well spent. During our trip we visited Geneva and decided to take a tour of the United Nations complex. Since I had my RSGB membership card with me and could therefore prove I was a licensed radio amateur, I decided to try to visit 4U1ITU. (This is available to any visiting amateur on proof of holding a current license.) The guides at the UN visitor center knew nothing of the station, although they spent some considerable effort trying to find some details. Eventually, I gave up and joined the regular sightseeing trip.

On the way back to town, I found the station. Well, almost, for on top of the ITU (International Telecommunications Union) building opposite the UN is a 3-element HF beam plus a mixture of VHF/UHF beams. So, on the next trip to Geneva, it's the ITU building that will be stop number one.

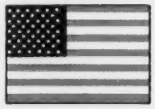
As usual on return from holiday, there was a mountain of mail. As well as some bills and a number of magazines (including *73*), there were a few applications for the Cheshire Award which I manage.

The UK is divided into counties which correspond with something between counties and states in the US. The county of Cheshire is centered on county town Chester and is situated between North Wales and Merseyside. The Cheshire Award is available to licensed amateurs and listeners in three categories—Gold, Silver, and Bronze for 50, 30, or 15 points, respectively.

QSO points for US stations are 5 por CW/SSB contact, 10 per FM contact, and 15 per SSTV/RTTY or satellite contact. A QSO with Chester counts double points. Any readers interested in obtaining the Cheshire Award should send $3.00 to me with a copy of their relevant log extract (QSLs are not required). An application form with full details is available for $1.00.

I will return to the subject of UK awards later.

It seems no time since I started writing this column for *73* and yet this is already the sixth edition. You should by now have the measure of my approach to the column, but if you would like me to cover anything specific, please write to me. Remember, though, that there is a delay between writing and publication that makes coverage of topics such as contests rather difficult.



GUANTANAMO NAVAL BASE

James Sackey KG4SH/KA2SHH
Secretary/Treasurer,
Guantanamo Amateur Radio Club
PO Box 73
FPO New York 09593

The Guantanamo Amateur Radio Club (GARC) is alive and well at the US Naval Base, Guantanamo Bay. GTMO, as it is known in the Navy, the oldest US naval base on foreign soil and the only one not in a communist country, is the assigned duty station of about twenty hams, ranging at present from a recently graduated and licensed Novice up to and including Extras.

As GTMO is outside of the FCC jurisdiction, the Commander Naval Base (COMNAVBASE) is authorized by the Department of the Navy, Navy Telecommunications Manual, to license and authorize amateur operations. To be licensed to operate from KG4-land, you must be stationed here, have in your possession a valid stateside license, and fill out the proper paperwork. Then the communications officer, under authority of COMNAVBASE, issues a 2×2 GTMO call. A ham can request any two-letter suffix.

Club president is Gary Murphy KG4DX, who, as you might expect from his choice of call, is very interested in working DX. Club meetings are held on the third Monday of the month at 2300Z, at the club station, located in hobbyland—the area of the base that houses the photo club, woodworking, and ceramics centers. Any ham visiting Guantanamo Bay is welcome to attend.

KG4AN, the club call, hasn't been too active recently since the Collins S-linear gear is on its last legs. The club is trying, through the Navy Special Service, to obtain funds for a new TR-7 and accessories. If the funds are available, the club might have the new gear on line by the end of this year.

This year, Tim Miller KG4TM/WB0RXX taught a Novice class that was both well received and successful. Of the seven who started the class, the only one not to be tested or licensed was a young boy who would rather play and be a distraction than study the code. The start of the classes was published in the base newspaper and broadcast over the local Armed Forces Radio and Television Service (AFRTS) radio and television stations on base. Among those who attended the class was a navy journalist who produced some of the announcements.

Not being content with only one ham class, KG4TM is again teaching prospective new Novices, so within the next months, listen for more KG4s on the Novice bands. For the information of newcomers to the ham ranks, KG4 counts as a country on the DXCC list. By the way, give new Novices a break—they will be scared silly when they first get on the air and are on the receiving end of a pileup...it's enough to make a guy wish he had studied something sane...like bomb disposal.

Speaking of DXCC, the GARC sponsors a Worked All GTMO award, which I will write about at a later date.

Continued on page 148

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Make a Good L-Meter Even Better

Give the N5CC design a boost. Tack on this two-stage buffer and dodge those sneaky loading problems.

Carroll R. Bryan III WB1HKU/6
7311 Variel Avenue 4
Canoga Park CA 91303

Anybody who tried to run their W5JJ/N5CC L-meter (*73*, December, 1981) into their Max-50 or Micronta model 351 frequency counter probably got the same nasty surprise that I did—it didn't work. The display kept flashing, with a different reading each time, whether the counter was powered by a plug-in power supply or an internal battery.

The L-meter is a beautifully simple circuit, and I found it to be quite useful once I'd corrected the problem. The frequency counter is also a beautifully simple circuit, quite useful and relatively inexpensive. Anybody who owns one knows that he got what he paid for; part of what he didn't pay for, and didn't get, is a high impedance input and a buffering ten-to-one probe.

Using my scope, I saw that the counter input was loading the L-meter oscillator output way down and detuning it as well. Anybody who tried to make the connection work and who doesn't own a scope, now hear this: Pay off your analyst; it's not your fault; you've just got a little bit of work to do.

In my initial irritated reaction, I decided on some *QST*-style overkill. Perhaps a single buffer stage would do, FET or bipolar. But, I decided that if I was going to use this circuit as a bench instrument (it's sorely needed on my bench; have you ever tried to dip-resonate a ferrite toroid?), I wanted no sneaky loading problems to complicate things. Hence, the two-stage buffer with the "Are you really there?" 5-pF capacitor into the FET.

The figures tell pretty much the rest of story. I've included voltage measurements from my unit to aid you in bringing it up. Substitute parts anywhere you think you can get away with it, but don't be tempted to scrimp on the decoupling—mine motorboated at roughly 2 Hz until I filled in the missing capacitors. Any-

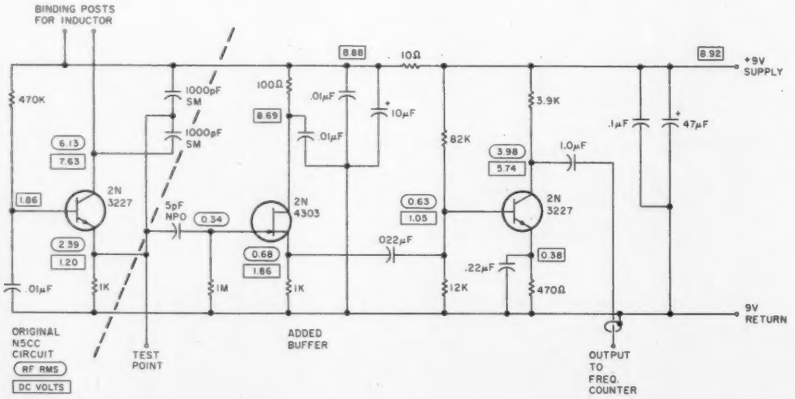

Fig. 1. Bipolar transistors can be 2N2222, 2N3904, etc.; FET can be HEP-801, MPF102, or another rf or general-purpose device. Dc voltages were measured with a 1k resistor in place of an inductor, using a Micronta/Sinclair DVM with 10-megohm input. Rf voltages were measured with a 100-uH Wee-Ductor inserted, using a VTVM-type rf probe into the DVM. My unit draws about 5 mA from a 9-volt supply.

812-422-0231

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THE HAM SHACK

449

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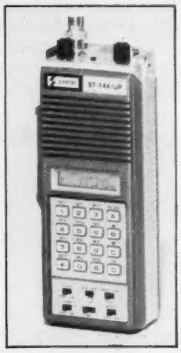
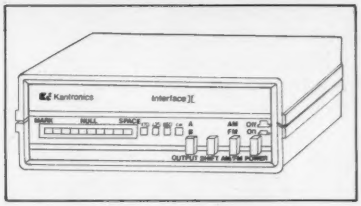


SANTEC 144/μP



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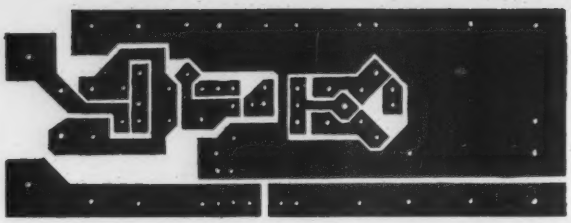

Fig. 2. Printed-circuit etch pattern. Drill holes are in a .1" grid; anyone using a drill/cut-and-peel technique, as I did, can use perfboard as a drilling template. With a little bit of fudging, the binding-post pads can be soldered directly to the wire terminals of a standard double binding post with ¾" pin separation.

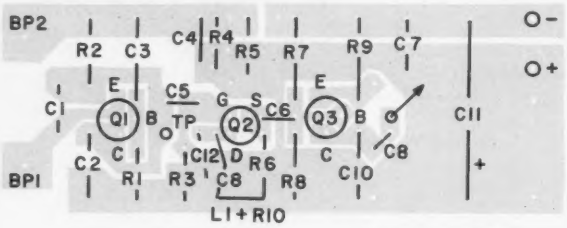

Fig. 3. Component layout. Use a piece of clipped lead for the test point. Check the data on your FET for pinout before installation.

Parts List

C1, C2	100-pF silver mica or polystyrene (NPO if available)
C3, C4, C10	.01-uF ceramic (.1-uF monolithic ceramic if available)
C5	5-pF NPO ceramic (silver mica is second best)
C6	.022-uF ceramic or polyester
C7	.22-uF ceramic or polyester
C8, C9	1.0-uF monolithic ceramic, ceramic, tantalum, or aluminum electrolytic
C11	47-uF aluminum electrolytic
C12	10-uF tantalum or aluminum electrolytic
L1	1 or 2 ferrite beads—FB43-101
Q1, Q3	NPN switching transistor—2N3904, 2N2222A, 2N3227
Q2	N-channel JFET—MPF102, 2N4303
R1	470k, ¼-W, 5%, c-c or c-f
R2, R5	1k
R3	100 Ohms
R6	82k
R7	12k
R8	3.9k
R9	470 Ohms
R10	10 Ohms
BP1, BP2	builder's choice—5-way binding posts, Fahnestock clips

body who's starting fresh on this circuit might find my PC pattern useful; refer to the original article by Carl Drumeller W5JJ for calibration information.

My thanks to William Huffman N5CC, whose design is coming in mighty handy at my station. ■

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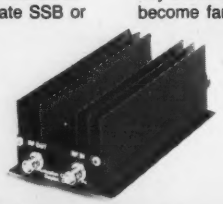

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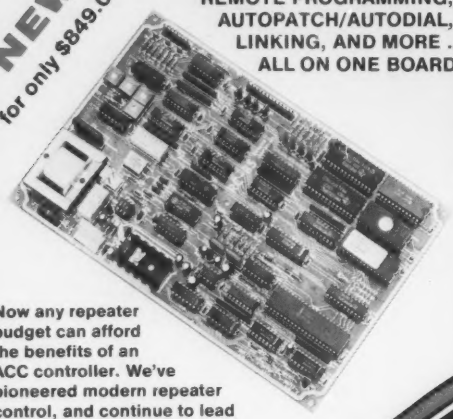

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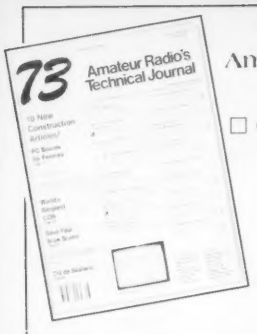

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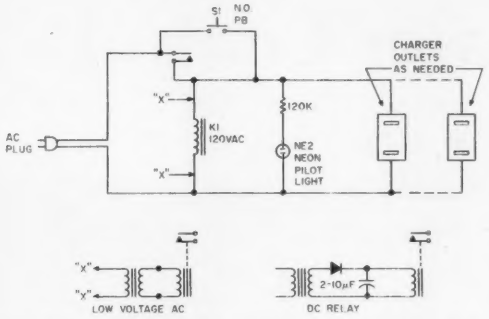
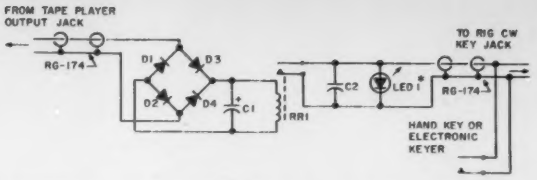
CIRCUITS

Do you have a technique, modification, or easy-to-duplicate circuit that your fellow readers might be interested in? If so, send us a concise description of it (under two pages, double-spaced) and include a clear diagram or schematic if needed.

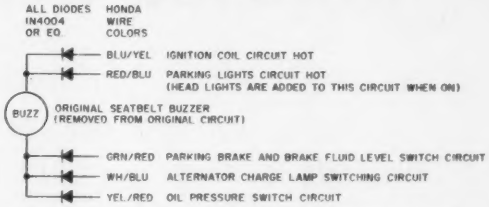
In exchange for these technical gems, 73 offers you the choice of a book from the Radio Bookshop, *to be sent upon publication. Submit your idea (and book choice) to: Circuits, Editorial Offices, 73 Magazine, Peterborough NH 03458. Submissions not selected for publication will be returned if an SASE is enclosed.*



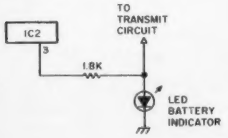
LIMIT YOUR CHARGE TIME: This circuit can be used with a 24-hour timer to limit the charging time of your batteries. To use, set a timer to have an on time equal to the charging time of your batteries. Plug the timer in and plug the circuit into the timer. Pushing switch S1 will energize the charger outlets for as long as the timer stays on. After turning off, the circuit will not reactivate until S1 has been pushed. The relay is a 120-V-ac unit, but a low-voltage ac relay can be used with a suitable transformer.—George Lundberg WA9JBH, Oak Forest IL.



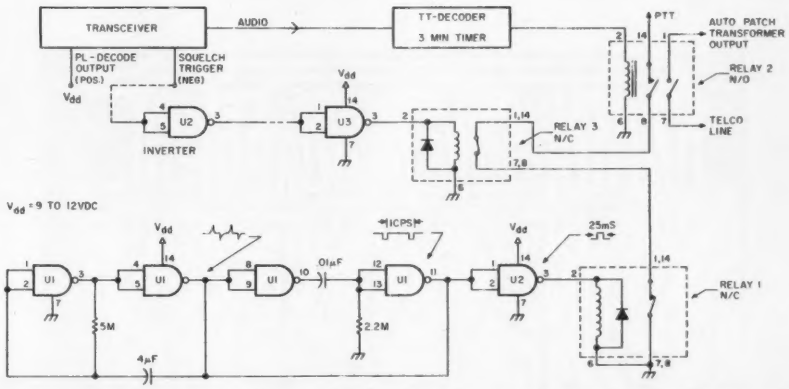
INEXPENSIVE MEMORY KEYER: By passing prerecorded audio from a tape player through a full-wave bridge rectifier, the audio is converted to on-off pulses which key the transmitter through a reed relay. Use a code-practice oscillator or sidetone generator to record the message. C1 holds the voltage across the reed relay (RR1) for the duration of the pulse. For use at speeds over 20 wpm, you will have to experiment with the value of C1. Also, be sure to record your message with enough voltage to operate the coil of RR1. D1–D4 are the rectifier diodes; C1 is a 200-uF 15-V electrolytic capacitor; C2 is a .01-uF disc capacitor; and LED 1 is an optional LED visual indicator.—William Edwards N8ARW, Niles OH.



IDIOT BUZZER FOR THE 1978 HONDA CIVIC: This circuit uses an existing seat-belt buzzer to indicate a fault condition in a variety of automobile systems. The buzzer will sound whenever the brake fluid level is low, when the oil pressure is low, when the alternator is not working, or when the parking brake is on. However, either the ignition or the headlights must be turned on for the circuit to operate. Correct wires must be found by testing as well as by color codes, because Honda uses the same colors for more than one circuit. Cars using idiot lights for the temperature instead of a gauge may include this feature by adding one more diode.—Franklin E. Swan W9SIA, Oak Forest IL.



RECEIVE INDICATOR FOR ICOM HTs: Use the transmit/battery LED to tell you when your 2AT, 3AT, or 4AT is receiving a signal. Connect a 1.8, ¼-W resistor between pin 3 of IC2 (the audio ouput amplifier) and the anode of the LED. IC2 is a single-in-line package located next to the speaker hole on the receive PC board at the front of the rig. Pin 1 is the pin toward the center of the board. Connect one lead of the resistor to the third pin and extend the other lead with a short piece of insulated wire. The wire should be soldered to the pad where R56 connects to the wire going to the LED. When the squelch breaks, this modification will cause the LED to light, but transmit operation will not be affected.—Robin Rumbolt WA4TEM, Knoxville TN.



SIMPLEX AUTOPATCH RECEIVE WINDOW: This circuit will provide a 25-millisecond window once per second. It is especially suited to making your own simplex autopatch system. U1 and U2 are 4001 quad, 2-input NAND gates, Radio Shack number 276-241. U3 is a 4093 quad, 2-input NAND Schmitt, Radio Shack number 276-2493; relays 1 and 3 are Magnecraft DIP type W217 DIP 19 SPST-NC; and relay 2 is a Magnecraft DIP type W117 DIP 11 DPST-NO. Both types are available from GSN Electronic Components, 91 W. Passaic Ave., Rutherford NJ 07070.—David C. Smith WB2EPZ, Jupiter FL.

MULTI-PURPOSE CONDUCTIVE TAPE: The copper-foil tape used by stained-glass enthusiasts makes an excellent material for rf-proofing enclosures, custom-shaping ground planes and making PC-board layouts. The tape's adhesive is nonconductive, so when you are joining two pieces of tape, make sure you solder the joint. This copper-foil tape is available in a variety of widths at most crafts stores.—M. Rosenzweig WB2BOM, Steamboat Springs CO.

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Ironclad Repeater Control

With 12 outputs and tamper-free access, you can keep a firm grip on your repeater's operations. And this circuit keeps the price from getting out of hand.

My requirements in a tone decoder were to control a 220-MHz repeater system with an autopatch, amplifier, and several other functions.

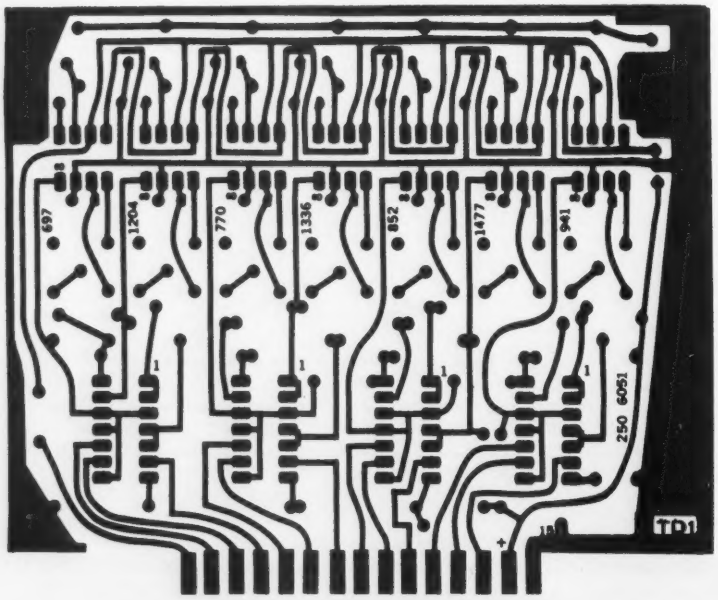

Fig. 1. Tone-decoder PC board, foil side.

The final design of this dual-tone, 12-output control board is used for selectable tone squelch, station identification, amplifier ON/OFF, and many security functions such as repeater and autopatch access through an access-control board requiring three-digit commands.

The tone-decoder board (TD-1) is constructed on a standard plug-in card and utilizes the type LM567 phase-locked loop and the National-type CD4025BCN Cosmos logic gates to detect audio tone pairs and provide 12 outputs.

The PLL's free-running frequency is set by means of potentiometers R8 through R14, in conjunction with resistors R15 through R21, and capacitors C17 through C23. In the presence of an audio tone of proper amplitude (20 to 200 mV/rms) and frequency, a

Tone-Decoder Parts List

R1–R7	4.7k Ohm
R8–R14	5k Ohm
R21–R28	10k Ohm
R15, R17, R19	8.2k Ohm
R16, R18, R20	3k Ohm
C1	22-uF electrolytic
C2–C8	1-uF electrolytic
C9–C15	2.2-uF electrolytic
C17–C23	.1 uF
C16	6.8-uF electrolytic
C17	.68 uF
U1	5-V reg.
U2–U8	PLL-type 567
U9–U12	Triple NOR 4025B
PCB	TD-1

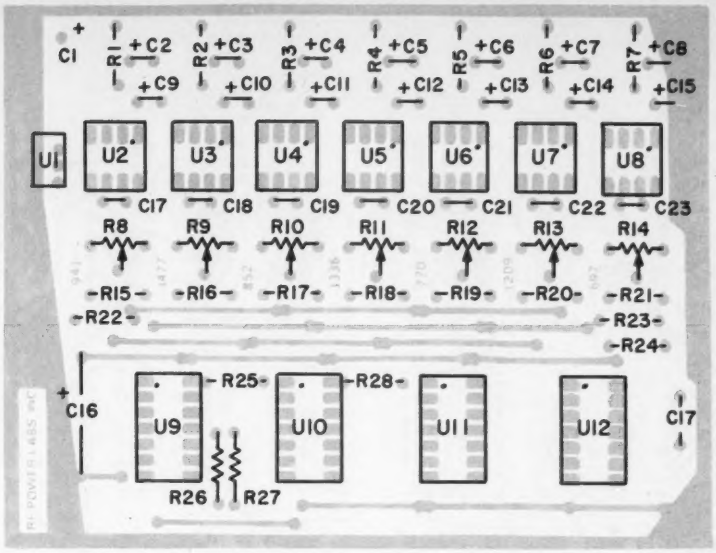

Fig. 2. Tone-decoder PC board, component side.

PLL will lock to the incoming signal after a variable number of cycles, depending on the amplitude and phase relationship at the moment the tone starts. When the PLL locks, its output changes from a high to a low condition (pin 8 of the 567s).

Pairs of one high- and one low-band tones will activate two of the decoders, which will result in low outputs. One of the logic gates in the 4025 integrated circuits will detect the combination and produce a high output. The board is intended to work with power supplies from 7 to 15 V. The voltage regulator, U1, provides 5 V for the 567 ICs. If 5-V operation is required for all the board, U1 can be removed and a jumper used to connect the 12- and 5-V lines together. Three input NORs are used for lower output impedance and circuit layout symmetry.

Testing

Using a frequency counter, check pin 5 of each 567. Set the free-running frequencies for the marked values ±5 Hz by using the corresponding potentiometers. 20 mV/rms of each tone should be sufficient to lock the PLLs.

If a frequency counter is not available, a tone encoder can provide the necessary test tones. The amplitude used should be reduced to the point where locking takes place (close to 10 mV or so), in order to guarantee the smallest bandwidth to the decoders and the best setting.

I am sure you will find many station-control applications for this decoder. A touchtone™ pad near your operation position can consolidate commands for automatic ID transmissions, changing antennas, or starting up the coffee pot.

The PC layout shown is a double-sided board. Parts for this project are available through many sources or you can buy the entire TD-1 board, fully assembled and tested, from Frank Kalmus WA7SPR, 7016 N.E. 138th, Kirkland WA 98033, for $39.00, postpaid.

Access-Control Board

This access-control board

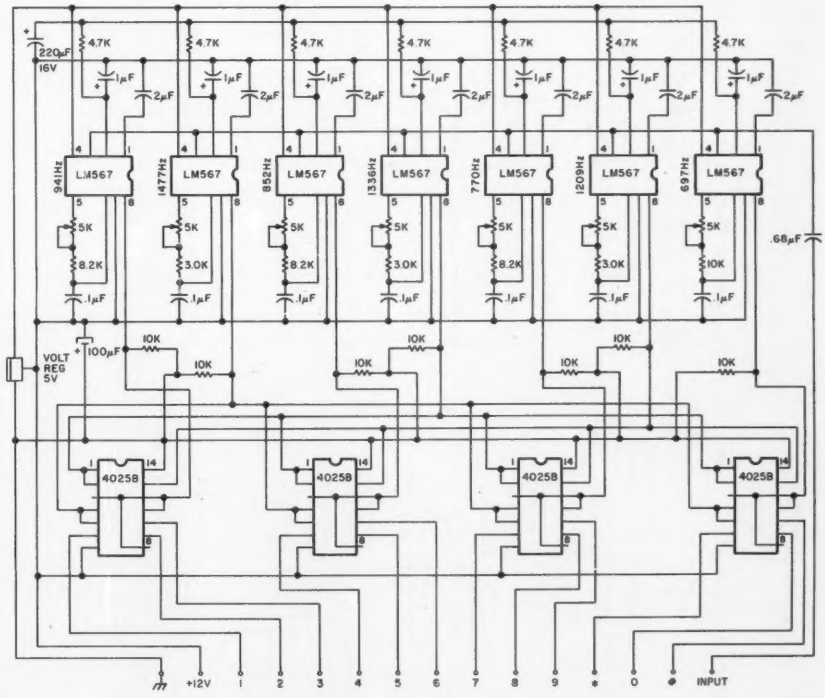

Fig. 3. Tone-decoder schematic.

will provide you with an exclusive access-security system. The access-control board is a logic unit designed to be used anywhere that sequentially-coded remote control is needed, i.e., with your tone-decoder board. The access-control board will provide five independent, three-digit coded circuits to use for repeater control, two-way radio systems, etc.

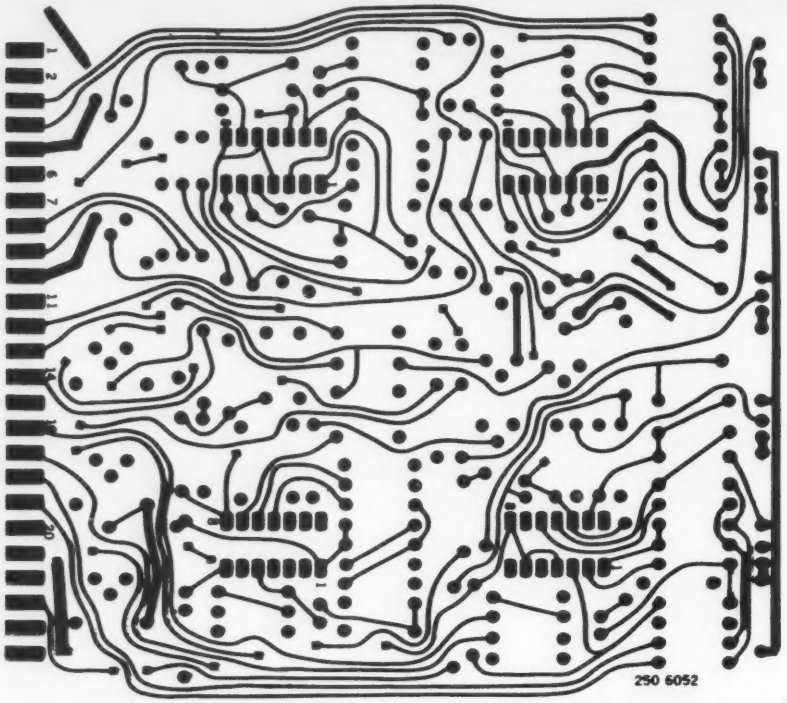

Fig. 4. Access-control board, foil side.

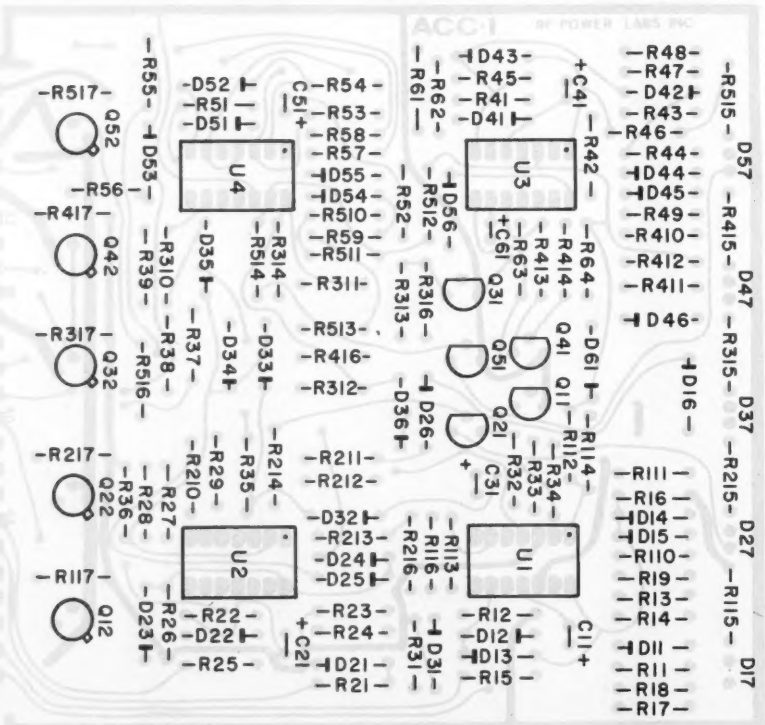

Fig. 5. Access-control board, component side.

The access-control board works with power supplies from 4 to 30 V and interfaces across any existing logic or analog system. Each of the five channels has four inputs. When three of the inputs are driven high in the proper sequence and within the preset time, the output will go ON or OFF, depending on the input used in the third place. In other words, the third and fourth inputs decide the output condition when inputs one and two have been previously activated.

The timing section in each channel defines how much time can be used to perform the complete sequence. The power ON reset is built-in, and a clear line is available to disable all channels at any time, if needed. Five LEDs are used to monitor the output condition of each channel.

The following theory of operation refers to one of five identical channels. When activated, the first stage works as a timer and enables the second input. The input threshold is roughly (Vcc/2 + .7)V. Once the input is above the threshold level, the output of the comparator goes high and enables the input of the second stage. At the same time, capacitor C1 is charged through R2. When the input goes low, C1 starts discharging through R2 and holds the comparator high for the timing period (recommend 2 seconds). The threshold of input 2 is Vcc/2. Once this threshold is overcome, the comparator goes high and diode D3 will hold that condition as long as the first comparator is also high.

The second stage gates both inputs of the third

through D4 and D5. This final comparator is designed in a bistable mode obtained by using proper feedback (R11 and R13) and input isolation (R9 and R10).

The transistor, Q1, drives the monitor LED which lights when the output is ON. Q1 is the output transistor which is open when the output is high and conducts in the low condition. The circuit operates anywhere from 4 to 30 V. Above 15 V, it is recommended that the value of R13 be increased in order to keep the LED current below 50 mA.

Testing

Apply 12 V to the board (all LEDs will remain OFF). Using a jumper, put 12 V sequentially in inputs 1, 2, and 4 of one channel, not taking more than approximately 2 seconds for the process. The LED will light after input 4 is activated.

Repeat the procedure, but ending with input 3 (the LED will shut OFF). During the timing period, the output can be switched ON and OFF by alternately touching inputs 4 and 3. Using a voltmeter, check the output voltage in the high (Vcc) and low (ground) conditions.

Repeat the same steps with the remaining four channels.

To check the "Clear" line, ground it using a jumper. All channels will shut OFF as long as the ground is present, whatever the input conditions are.■

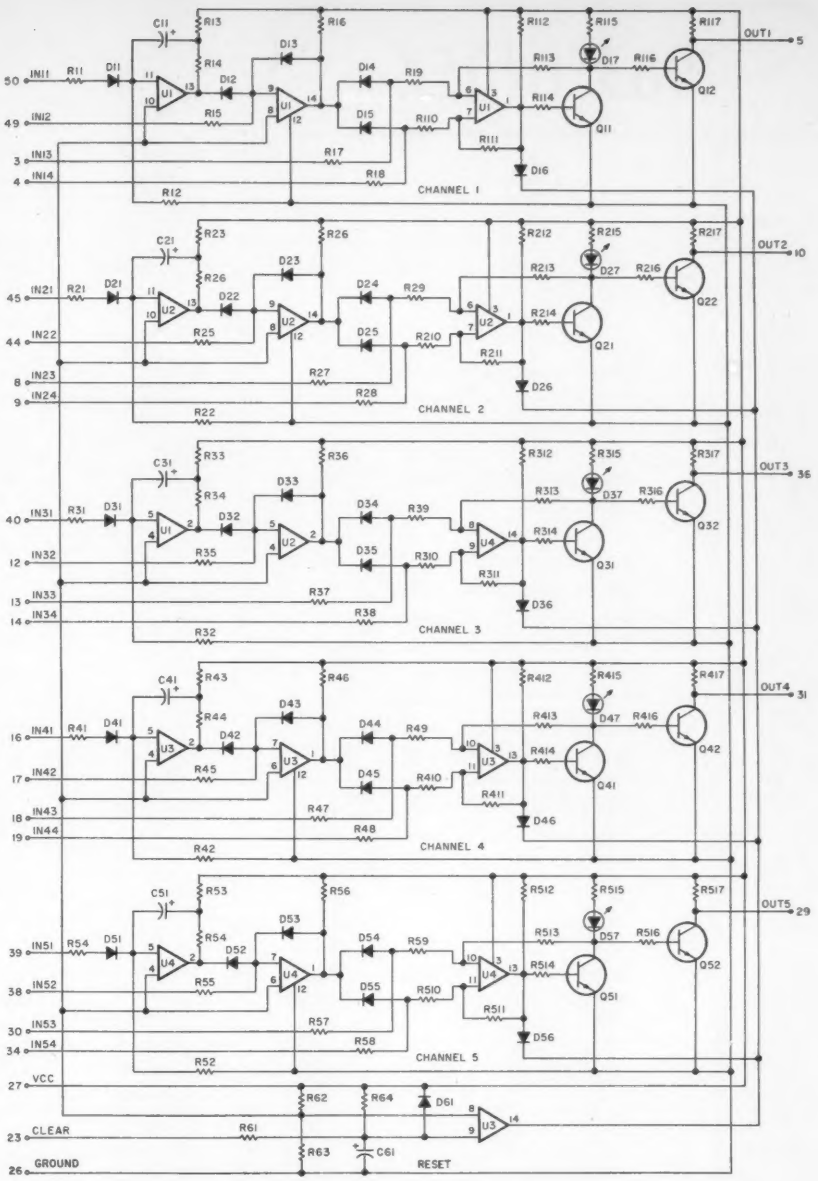

Fig. 6. Access-control board schematic.

Access-Control Board Parts List

Reference	Qty	Description
R15	5	Resistor, 330-Ohm, ¼-W, 5% carbon
R3, R17	10	Resistor, 1k-Ohm, ¼-W, 5% carbon
R1, R4, R6, R12, R14, R16	30	Resistor, 10k-Ohm, ¼-W, 5% carbon
R5, R7, R8	15	Resistor, 30k-Ohm, ¼-W, 5% carbon
R9, R10, R11, R13	20	Resistor, 100k-Ohm, ¼-W, 5% carbon
R2	5	Resistor, 270k-Ohm, ¼-W, 5% carbon
C1	5	Capacitor, 35-V, 6.8-uF electrolytic
D1 through D6	30	Diode, switching 1N914
D7	5	LED (Red) Monsanto MV 5023
Q1, Q2	10	Transistor, NPN 1 Amp, 45 V
U1–U4	4	LM339

Reset Circuit

R61	1	Resistor, 330-Ohm, ¼-W, 5% carbon
R62, R63	2	Resistor, 10k-Ohm, ¼-W, 5% carbon
R64	1	Resistor, 100k-Ohm, ¼-W, 5% carbon
D61	1	Diode, switching, 1N914
C61	1	Capacitor, 35-V, 6.8-uF electrolytic
ACC-1	1	Printed circuit board

Standard parts are used throughout. If you have any difficulty locating these parts, contact Frank Kalmus WA7SPR, 7016 N.E. 138th, Kirkland WA 98033 for assistance. A completely assembled and fully-tested ACC-1 can be purchased for $37.50 postpaid.

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Put 2 Meters in Your Shirt Pocket	receiver conversion	K3PJG	MAR 46
Push Your Radar Detector to the Limit	simple modification	W5LFM	MAR 86
Make the Icom 720A Work for You	antenna switching	N4BL	MAY 46
Make Your Noise Bridge Even Better	calibration shortcuts	K4KI	MAY 64
Strangle QRM with Your TS-830S	interference filters	KA2R	JUN 36
The Totally-Modified 2000	add-ons for 2M rig	W1GV/4	AUG 50
Send Your TR-7800 to Obedience School	fix quirks	KE6VK	AUG 54
Cheap Scanning for the IC-701	cheap extra feature	AG9D	AUG 64
Terrific Top-Band Conversions	160-meter surplus	K9QLL	NOV 40
The World's Cheapest Modification	FT-101 on 30 meters	WB9DDF,W0UR	NOV 70
Streamline the IC-25A	remote control and more	W2PQG	DEC 48
A Perfect Match for the HW-8	30-meter modification	WA6BJH	DEC 52
GADGETS			
The Care and Feeding of Optoelectronics	wind vane	K3VDB	JAN 62
Stop That Heist!	portable alarm	WD5JWY	FEB 72
Electronics vs. Creepy Crawlers	ultrasonic oscillator	K7YZZ	FEB 90
Twisted Remote Control	telephone control	WD5JWY	MAR 64
73 Cents for a Voltage-Transient Detector	cheap protection	WB8OWM	MAY 83
Build the Weather-Grabber	2-meter converter	N1II	JUN 84
Down-Under Depth Sounder	for boats	Harleck	JUL 82
A Colorado-Style Battery Monitor	saves nicads	Wilson	AUG 48
1001 Uses for the 9400	application ideas	W3KBM	AUG 88
Build This Super Switch	for the shack	K4YS	SEP 52
The Phase-Shift Oscillator Goes Hollywood!	audio circuit design	Goodson	OCT 54

TITLE	DESCRIPTION	AUTHOR	ISSUE
Build the Harmonic Zapper	20-meter trap	W2YW	OCT 56
World's Fair Super Squelch	2-digit DTMF decoder	WA4TEM	OCT 86
A Two-Tone Squelch to Solve Your Scanner Woes	selective listening	WA3REY	NOV 84
Warning: Your Time's Up! Babysit Your Battery	timer add-on	N7BH	DEC 78
	intelligent charger	WA4TEM	DEC 86
I/O			
Active-Filter Design Made Easy	Basic program	WD4HPC	JAN 78
Error Protection for Digital Transmissions	block coding	W9JD/2	FEB 64
Personalize the M800	easy modification	VE4AFO	MAR 94
RTTY Program	sound synthesis	WB9EGA	APR 32
Exploit the Hidden Interfaces of TRS-80	computer communications	AF2M	MAY 48
The New Communications: VHF Mailboxes	for the TRS-80	WB8JEY	JUN 48
A QSL Assembly Line of Your Very Own	hard and software	AF2M	JUL 54
Apple, Morse, and You	Pet Basic	VK3BHM	JUL 56
Micro McElroy	code practice program	W7LTH,KA7AQA	AUG 14
VisiCode: The Vic-20 Way to Extra Class	printer program	KF9X	AUG 38
Faultless SSTV Picture Presentation	plans and sources	KB2GA	SEP 40
Home Brew an Apple Computer--And Save!	for TRS-80C	K6AEP	SEP 58
Colorful RTTY: An Advanced System	dupe program	WB0NFX,W0CZ	OCT 84
Take the Drudgery Out of Contesting	make sense from numbers	N6RY	NOV 36
Reveal the Receiver Behind the Specs	churns out QSL cards	WB5LLM	NOV 46
CardSoft: The Transportable QSL Foolproof	logbook program	KL7GRF	NOV 58
Logging	list-keeper	WA4VLE	NOV 62
The Program No Net Control Should Be Without	TRS-80 DXCC program	WO4L	DEC 77
Micro Power for the DXer			
MISCELLANEOUS			
My Own Silver Mine	reclaiming silver	W1FLP	JAN 46
International Success Story: The BBC	British SW station	Peterson	JAN 68
Ham Radio Hits the '82 World's Fair	Knoxville station	N4AQI	FEB 58
The Denali Connection	Alaskan adventure	KL7RD	FEB 60
Get the DX Edge!	speaking Spanish	KB9SP	FEB 76
Adventure in Sarawak	DXpedition	VK9NL	MAR 42
Scandinavia: The 2m Dream Vacation	reciprocal licensing	WA6OGW	MAR 58
How E.T. Really Called Home	E.T.'s communicator	K2SSQ	APR 52
Buyer's Guide To Dayton	Hamvention guidelines	WA4BPI	APR 56
The True Story Behind Heard Island	the HIDXA expedition	VK9NL	JUL 20
Yasme and the Call of Abu Ail	DXpedition	W6KG,W6QL	JUL 94
Running Scared at Spratly	1979 DXpedition	KB7NW	AUG 20
To Go Where No Ham Has Gone Before--Sealand!	DXpedition	DF2AO	AUG 84
"10...9... 8..."	STS-9 details	WA6ITF	SEP 8
Become a Low-Band Pioneer	1700 meters	KL7GLK	OCT 34
Defuse RFI	get a good ground	W0WUZ	OCT 88
Octal Ingenuity	fixing old radios	W9SIA	NOV 88
"We've Been Boarded!"	high seas adventure	W9UUC	DEC 32
Don Wallace: Superham	meet the Grand Old Ham	W6CK	DEC 56
Courage for Would-Be Hams	the Handi-Ham system	Norgard	DEC 78
MOBILE & PORTABLE			
The Forgetful Auto-dialer Puzzle	reprogrammable	W7BBX	JAN 40
Drive-Time SWLing	car radio converter	AG9C	FEB 70
You Can Troubleshoot Mobile Noise	hash elimination	K5CA	FEB 88
No-Crash Autopatch	autodialer	W3ZC	APR 20
Turn Mobile-Rig Whine into a Whimper	filtering	K4AJQ	APR 30
New England's Nicad Per-Charger	automatic	K1QPS,WA1UNU	APR 38
Immortalize Your IC-2AT Battery Pack	miniature power supply	KP4AQI	APR 40
The Best Way to Mount Your Mobile Rig	for vans	KE7X	APR 64
The Ultimate Protection Plan for Your HT	stop wear & tear	K2YKE	APR 92

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NEVER SAY DIE			
The View from Overseas			JAN 6
It's Snow Fun			JAN 6
Hamming For Credit?			JAN 118
Digital Mania			JAN 120
Computerizing			JAN 120
Help!			JAN 120
Builders vs. Buyers?			JAN 122
How's the ARRL Doing?			JAN 122
Major League Changes			JAN 122
Are You Missing the DX?			JAN 123
Sabah!			FEB 6
The Connecticut Contest And Certificate Club			MAR 6
The Code			MAR 8
Bashed Yet?			MAR 101
Too Much Science?			MAR 101
Another Ogre			MAR 101
Asian Tour			MAR 102
Down With DXCC			MAR 102
Taiwan in Trouble			MAR 103
Importing Military Tech			APR 6
My Wish Book			APR 6
Crappy American Products?			APR 8
See You at Dayton?			APR 126
Earphone Jacks			APR 126
Breaking Loose			MAY 6
The ASCII Inrush?			MAY 6
What Computer?			MAY 8
Solving the Jobs Problem			MAY 106
The Ultimate Emergency			MAY 108
Surviving EMP			MAY 108
A Kerchunk Substitute?			MAY 108
Calling Captain Queeg			JUN 6
Viva the Code!			JUN 126
What Are You Reading?			JUN 126
The Dayton Daze			JUL 6
Real Hams			JUL 8
Other Daytonia			JUL 8
Dangerous DXing			JUL 8
Digital Perspective			JUL 124
Dentron			JUL 126
Still Another FCC Revolution			AUG 6
Jobs and Careers			AUG 102
Potential Growth			AUG 102
WWII Final Battle Won!			AUG 103
Sci-Fun			AUG 104
The Agony of Defeet			AUG 104
Green Sells Out			SEP 6
Instant Genius			OCT 6
What's Green Really Up To?			NOV 6
Foreign Gift Subs			DEC 6
Aspen Ham Convention			DEC 6
Getting Into the Ham Business			DEC 126
Poverty-Stricken Hams			DEC 126
A Look at Pirates			DEC 127
NEW PRODUCTS			
ACC	ITC-32 Control Board		JUN 100
AEA	Moscow Muffler		FEB 100
AEA	AMT-1 AMTOR Unit		AUG 116
Automated Production	EX-1000		JUN 101
Azden	PCS-4000 Transceiver		JAN 142
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BHC, Inc.	Ham-Tags		SEP 107
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Bird	Plug-in Element		SEP 108
Blacksburg Group	Slinky Dipole Chart		MAY 124
Bytesize Micro Tech	VIK-Dubber		OCT 102
CES Products	Thin-Coder		FEB 100
CES Products	Memory Dialer Chip		MAR 122
Channel Master	Satellite Stereo		MAY 126
Com-Rad Industries	Hi-Rizer Antenna		APR 117
Com-Rad Industries	DDRR Range Extender		MAY 124
Com-Rad Industries	440-MHz DDRR		DEC 119
Communications Concepts	ATV-2 Converter		AUG 116
Computer Applications	Satellite Program		MAY 124
Contemporary Technology	TMC-1B Interface		SEP 108
Continental Satellite	Silver Wax Disk		AUG 116
Crystal Mfg. Company	Crossover List		AUG 116
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DB-Gain	Antennas		MAY 126
Digital Microsystems	Control Chip		JUL 118
Dotronix	DTU-12 Data Display		MAR 121
e-tek	Digital Wattmeter		APR 118
Electra	DX-1000		NOV 115
Electronic Specialists	Power Interrupter		FEB 101
Electronic Specialists	ISO-17 Magnum Isolator		MAR 121
Encomm, Inc.	Antenna Tuners		MAY 126
Encon, Inc.	Photovoltaic Panels		JAN 143
Encon, Inc.	Photovoltaic Panels		NOV 116
Faxscan	BP-4 Beeper		NOV 116
Flesher Corp.	TU-470		SEP 106
Flesher Corp.	ROM-116 Interface		OCT 102
Fogg and Egan	Headlights		DEC 119
Fox Tango	WARC Bands Kit		NOV 115
Gary Woodall	Comp-Code		NOV 115
GFS Electronic Imports	RTTY Modem		APR 116
Gillaspie & Associates	TVRO Receiver		JUL 118
GLB Electronics	Packet Radio TNC		DEC 118
Global Specialties	Counter-Timer		FEB 100
Global Specialties	Frequency Counters		APR 116
Grove Enterprises	Antenna Preamplifier		FEB 101
Grove Enterprises	Scanner Converter		APR 116
Grove Enterprises	Receiver Multicoupler		JUL 119
GSM, Inc.	Quartz Crystal Guide		NOV 115

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HAL	RPT3100 Software		MAR 121
HAL	RTTY/CW Terminal		JUN 101
HAL	CT2200 Terminal		OCT 103
HAL	ARQ1000 AMTOR Terminal		NOV 115
Hamtronics	1983 Catalog		MAR 120
Hamtronics	DTMF Decoder Module		JUL 118
Handi-Tek	Battery Eliminators		APR 116
Heil Sound, Ltd.	Transverter		JUL 118
Heil Sound, Ltd.	Remote-Base Control		SEP 107
Heil Sound, Ltd.	FM-10T Transceiver		OCT 103
Hustler	G7-220 Antenna		SEP 108
Hustler	6-MB3 Antenna		OCT 103
Hustler	Triband Vertical		NOV 116
Hustler	440-MBx Vertical		DEC 110
Icom	IC-290H 2m Transceiver		JAN 143
Icom	IC-R70 Receiver		JAN 143
Icom	IC-751 HF Transceiver		SEP 106
Icom	IC-120		OCT 103
Industrial Computer	S-100 Function Boards		SEP 107
International DX Club	Review Supplement		JUN 100
International Radio	Kenwood Filter Kits		DEC 120
International Solar	Solar Battery Charger		FEB 101
J.C. Sprott W9AV	Morse Code Translator		JAN 143
Jameco Electronics	Adjustable Power Supply		MAY 128
Jim Grubbs	Prokey CW Software		SEP 108
John Yurek K3PGP	RTTY Software		FEB 101
Kenwood	R-2000 Receiver		MAR 121
Kenwood	TS-430S Transceiver		APR 116
Kenwood	2-Meter Mobile Xcvrs		JUN 100
KLM Electronics	143-150-14C Antenna		MAR 120
KLM Electronics	HT Power Amplifiers		APR 117
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Lee-Art, Inc.	Belt Buckle		JUN 101
Magnum Distributing	Maxcom Antenna Matcher		SEP 107
Magnum Distributing	Maxcom Antenna Matcher		DEC 118
MCM Communications	Daiwa Linear Amplifier		DEC 119
MFJ	Video Control Center		MAR 120
MFJ	RTTY/CW Interface		MAY 124
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Microfish Software	VIC-20 RTTY		SEP 106
Micrologic	AIR-1 TU		AUG 116
Microwave Filter Co.	Tunable TVRO Filter		FEB 102
Microwave Filter Co.	30-Meter Ant. Coil		JUL 119
Microwave Filter Co.	Maxi Baluns		OCT 102
Microwave Filter Co.	440 FM/FF DC Inserter		DEC 118
Midian Electronics	Channel Scanner		JAN 142
Mitronix	KA9FSQ CW Modem		OCT 102
MX Products	HS-700 Headset		MAY 128
National Microtech	Apollo X-10 Antenna		JAN 142
National Microtech	Satellite Receiver		JUN 101
Non-Linear Systems	Frequency Counters		FEB 101
Non-Linear Systems	Test Adaptor		MAR 120
Non-Linear Systems	Test Leads		JUL 119
OK Industries	IC Inserters		APR 116
P.C. Electronics	Kreepie-Peepie		NOV 116
Palomar Engineers	DTMF Decoder		JAN 142
PolyPhaser Corp.	Impulse Suppressors		JAN 143
PolyPhaser Corp.	Lightning Protector		AUG 116
Royal	Contact-80 RTTY Program		MAR 121
Russ Software	Data File Maintenance		MAY 128
Simpson Electric Co.	467E LCD DMM		JAN 142
Simpson Electric Co.	470 DMM		FEB 100
SMR, Inc.	Facsimile Recorder		JUN 101
Tayco Communications	CATV Converter		APR 117
Teltone Corp.	DTMF Receiver Kits		MAR 121
Ten-Tec	Antennas		JUL 118
Ten-Tec	2591 HT		AUG 116
TET Antenna Systems	Swiss Quad for 6 Meters		JUL 118
Thermax Corp.	TC25G Generator		APR 116
Tokyo Hy-Power Labs	VHF Linear		JUN 100
Tripp-Lite	DC Power Supply		JAN 143
Ungar	9300 Soldering Iron		JUN 101
Ungar	9000 Soldering System		JUL 118
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Ungar	Soldering System		OCT 102
Unique Communications	New Catalog		OCT 102
Universal Electronics	Multi-Mode Receiver		APR 117
Universal Electronics	RTTY Publications		JUN 100
US Fiberglass	Stage 2 Antennas		NOV 116
Varian Associates	Frequency Chart		JAN 142
Yaesu	HF Transceivers		MAY 124
Yaesu	FT-726R Transceiver		JUL 119

OPERATING

Live, From Across America-It's Field Day!	television coverage	WB4EMI	JUN 22
Diary of a Partially-Sighted Ham	operating tips	WA6CNN	JUN 54
Kill Power-Line Interference	stop noise	K3UK	JUN 92
How to Increase Your QSOs	CW tips	N6HYK	SEP 34
Electronic Mail Comes of Age	HF mailboxes	K0VKH	NOV 86
			1

POWER SUPPLIES

			1
Power-Line Protection: The Weak Link	stopping surges	N8ADA	FEB 83
Higher Voltage, Less Weight	voltage quadrupler	W7CSD	FEB 84
Pedal Power: A Perfect Field-Day Generator	bicycle-driven supply	KN6H	APR 12
Construct This Customized Power Supply	5 to 30 Amps	W9ODK	AUG 8
Construct the Callsign Power Supply	put your call in lights	KA1QZ	NOV 10
Unlimited Guarantee for Power Supplies	design parameters	KC0EW	DEC 20

TITLE	DESCRIPTION	AUTHOR	ISSUE
RECEIVING			
Make Room for More Agc	flexible circuit	N7APE	FEB 86
The Magical Audio Filter	notch filter	W6QIF	NOV 14
Reveal the Receiver Behind the Specs	make sense from numbers	N6RY	NOV 36

REPEATERS

An Alarming Procedure	repeater alert	WA1LCF,K1FNX	JAN 24
Superman's Repeater Control System	4 independent outputs	K3IJ	FEB 32
The Q-Master Cavity Filter	high-Q filter	KB6AL	MAR 74
The COR of a Reliable Repeater	simple relay circuit	WA7SPR	AUG 24
Ironclad Repeater Control	12 outputs	WA7SPR	DEC 100

REVIEWS

Advanced Computer Cont.	RC-850 Controller	WA3VUP	JAN 126
AEA	CK-2 Memory Keyer	W1XU	FEB 104
AEA	BT-1 Code Trainer	WB8JLG	MAR 104
AEA	Moscow Muffler	W1XU	MAY 120
AEA	MBA-RC Converter	N8RK	JUN 103
AEA	KT-2 Keyer/Trainer	WB8JLG	JUL 120
AEA	AMTOR TU	AF2M	NOV 98
Alden Electronics	Facsimile Recorder	W1XU	FEB 102
Autek Research	QF-1A Filter	WB8JLG	MAY 116
Azden	PCS-4000	WB8JLG	MAR 104
Blacksburg Group	Fist Fighter	W1XU	APR 103
Buckmaster Publishing	Call Directory	WB8JLG	FEB 106
Computer Applications	Pathfinder II	N8RK	JUN 104
Connect Systems	Private Patch	AG9V	NOV 99
Cushcraft	A3/A73 Tribander	AG9V	JUL 122
Dovetron	Widget	WB8JLG	MAR 107
Electronic Rainbow Inc.	Satellite TV Receiver	WB9ZNU	JAN 126
Foundation Publishing	The Rest of Ham Radio	N8RK	APR 104
Galfo	Apple RTTY Program	AE5V	APR 104
Gordon West	Code Tapes	WB8JLG	JUL 120
Harvey-Brain	Seychelles Saga	W1XU	JUN 104
Heil Sound, Ltd.	HC-3 Mic Cartridge	WB8JLG	MAY 118
Hy-Gain	TH7DX Tribander	K1XR	JUN 104
Icom	R-70 Receiver	WA2VSN	FEB 102
Icom	TR-720	W1XU	NOV 100
Icom	IC-751 Transceiver	WB6TOV	DEC 109
International DXers	Shortwave Equip. Review	AG9V	DEC 109
James Anderson	Ghost Fighter's Guide	N8RK	OCT 110
Kantronics	Hamsoft RTTY Program	WB8BTH	APR 102
Kenwood	Panadapter	K1XR	MAY 116
Kenwood	TS-430S	WA4BLC	JUN 102
Kenwood	TR-8400	K1KA	OCT 108
Kenwood	TR-9500	K1KA	NOV 97
Larsen	Mobile Mount	WB8JLG	APR 102
Metheny Corporation	LJM2KR Storm Alert	K9MX	JAN 128
MFJ	Econo-Tuner	WB8JLG	OCT 110
Palomar Engineers	PT-407 Antenna Tuner	WB8JLG	FEB 105
RSGB	VHF/UHF Manual	WB8JLG	JUL 119
Santec	ST-uP Handie-Talkies	W2IVS	OCT 109
Ten-Tec	Corsair Transceiver	W1XU	MAR 105
Universal Electronics	RTTY Callbooks	WB8JLG	MAR 108
Yaesu	FT-102	WB8JLG	MAY 116

RTTY

RTTY Tuning: The New Solution	tuning indicator	WB2OSZ	MAR 10
Unlock the New Electronic Mailboxes	how to use MSOs	WB7QWG/9	APR 44
The New Communications: VHF Mailboxes	computer communications	AF2M	MAY 48
Join the Packet Radio Revolution	digital communications	WA7GXD	SEP 19
Be A RTTY Rembrandt	designing RTTY pictures	WA2OQJ	SEP 28
Join the Packet Radio Revolution	Part II	WA7GXD	OCT 20

SATELLITES

Up and Coming: Direct-Broadcast Satellites	new entertainment	N8RK	FEB 38
Work the Russian Robot Ops	Russian satellite use	K4TWJ	FEB 44
Uncover Equipment for OSCAR Phase III	flea-market shopping	K6KLY	MAR 18
Up and Coming: Direct-Broadcast Satellites	Part II	N8RK	MAR 26
The Secret Telemetry of OSCAR 8	decoding information	K5OM	MAR 52
Build the Armchair Satellite Tracker	OSCAR tracker	K3LP	MAY 84

TECHNICAL & THEORY

Error Protection for Digital Transmissions	block coding	W9JD/2	FEB 64
D'Arsonval Dossier	how meters work	W1OLP	JUN 10
Smart Meters: The New Movement	error-correction system	W4RNL	JUN 42
Do You Know Where Your Signal Goes?	radiation pattern	N4UH	AUG 56
Propagation Explosion on 220	field test results	W9MKE	AUG 90

TITLE	DESCRIPTION	AUTHOR	ISSUE
TEST GEAR			
King of the Pulse Generators	multi-purpose	WA3RJS	JAN 100
4-Tone Audio Oscillator -Potent Troubleshooter	computer-controlled	W7BBX	FEB 20
Take Your IC's Temperature	keeping them cool	W3KBM	MAR 70
Save Money On Used Meters	meter tester	W3QOM	JUN 19
Construct the Cyclops Dip Meter	single-coil	W4ATE	JUN 26
Two Meters for the Price of One	using shunts	KB2JN	JUN 34
Get Accurate with the Digital-Grid Meter	power meter	N1II	JUN 50
Hot-Spot Metering--Automatically!	money-saving designs	W4RNL	JUN 56
Put Together the Shawnee Logic Probe	CMOS and TTL	Roth	OCT 66
Make a Good L-Meter Even Better	two-stage buffer	WB1HKU/6	DEC 94
TRANSMITTING			
Action Machine for 20	SSB transceiver	WB5IPM	JAN 12
Fun-Equipment Revisited	transmitter & amplifier	WA8RBR	JAN 48
Your January Home-Brew Project	SSB exciter	VE7DOD	JAN 92
The Fun-Vac: A Synthesis of Old & New	1-tube transmitter	WA8RBR	MAR 32
Construct This Classic Transmitter	HF tube-type	W1BG	MAY 14
More Stable Than A Rock	10-MHz generator	DJ3NW	JUL 32
The Six-Meter Vfo That Won't Quit	rock-steady	N7APE	NOV 48
TVRO			
Build the Deadeye Dish Controller	rotator control	W5JG	APR 84
TVRO Troubleshooting	helpful hints	N8RK	DEC 40
VHF & UP			
The Amazing Cylindrabola	microwave antenna	WA4WDL	SEP 54

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HAM HELP

I have unfortunately lost the January, February, March, and April, 1961, issues of *73* as well as the November, 1962, issue. I will pay any reasonable price for those issues in good to fair condition.

William Ward DA2XA/W4PCK
USMCA Wuerzburg
CPO
APO NY 09801

I am looking for a manual for the Hammarlund HQ-100 receiver. I have manuals for the following available for trade: BC-348, ARR-16, Heath DX-40, Heath O-9 oscilloscope, TV-7U tube checker, ARN-6, and ARC-3-T67A.

Loren Willis
Box 282
Farmland IN 47340

I would like to find some CB radios that were made from 1968 to 1972. I do not care whether they work or not, as long as the transformers are not burned up and they have crystals in them.

Tony E. Byrum
1449 N. Midwest Blvd. #402
Midwest City OK 73110

I would like to hear from US and foreign teachers, students, and radio clubs that want to participate in an educational resource net for public schools. I can also provide advice to those who are beginning or reactivating a school station.

Michael Henderson N6JFD
Box 331
Somis CA 93066

I am trying to get information on using TTL logic devices to control 117-V-ac outputs. I am using the information to help disabled persons, and any assistance would be appreciated.

S. Raigner N7BNP
626 NE Floral PL.
Portland OR 97232

I need help in converting the "Open House" program, which appeared on page 72 of the January, 1979, issue of *Kilobaud Microcomputing*. The program was written in Wang Basic, and I would like to use it on a TRS-80 Model I, level II.

Lisle T. Hines K2QLA
4 Ellwood Ave.
Cortland NY 13045

I am looking for a schematic and power transformer data for a Knight wideband oscilloscope. I will pay shipping and duplicating costs.

Torgny Karlsson SM7CFQ
Sandormsvagen 7
S-260 41 Nyhamnslage
Sweden

I am searching for schematic diagrams, operating manuals, and service manuals for the Raynav 3000 LORAN-C navigation system. Please write before sending material.

Bruce Rahn WB9ANQ
410 Coronado Trail
Enon OH 45323

Wanted: info on the Electronica-360 10-meter mobile AM/SSB transceiver. I would like to modify the clarifier to operate on transmit as well as receive. I would also like to know if there is an American version of this European-market rig.

SSG Gary E. Kohtala DA2XF
USAFS-A, Box 1415
APO NY 09458

Can anyone provide information on the Airadio model TRA-10; Hewlett-Packard SHF generator model 670JM; AN/SRD-11 direction set; BC-1141-C and BC-1140-H mine detector set; PP-63 power supply; and 1-IJ-8 radio compass adapter, manufactured by Electronic Supply Co.?

John C. White WB6BLV
560 North Indiana
Porterville CA 93257

I am desperately in need of the schematics and operating manuals for a Hallicrafters S-107 receiver and a Globe Scout model 680 transmitter. I will gladly pay for the cost of copying and mailing the documents.

Richard Metro KA2QWH
201-D Springmeadow Drive
Holbrook NY 11741

I want to substitute a 4CX250 tube for the two 572B tubes in the Heath SB-200 linear. I think I have seen an article on it in one of the ham magazines. Can anybody help me locate that article?

Pete Govorko K6MMT
336 Demming Rd.
Sequim WA 98382

ROYAL CONTACT-80 MARK-II TRS-80 MOD. III-IV

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DX

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XU KAMPUCHEA

Late this past summer, several stations appeared on the amateur bands from Kampuchea (formerly Cambodia). These amateurs were operating under all international amateur-radio regulations, from within the internationally recognized borders of that country. Their licenses were granted directly by the prime minister of the government. In fact, the callsign of the first amateur station, XU1SS, reflected the initials of the prime minister, Son Sann. Yet the chances of contacts with XU1SS counting for DXCC credit are slim.

The XU1SS and other XU callsigns generated an understandable amount of commotion on the DX bands. Understandable because no legitimate Cambodian station has been on the air in many years—since the last Americans left in the early 70s. But this excitement is likely to be to no avail, since the XU1SS QSL cards will probably suffer a fate similar to those of XZ5A: as curios, not DXCC counters.

The amateur-radio operations in Kampuchea do bear a striking similarity to those in nearby Burma. The XU1SS operations were conducted under the auspices of the KPNLF (Kampuchea People's National Liberation Front), which is the "exile" government of Kampuchea. The KPNLF is the leading member of a loose coalition of political parties called "Democratic Kampuchea." Democratic Kampuchea is the officially recognized government of the country, even though they physically occupy one tiny corner of the country.

The socialist Kampuchean government, which gained power through force of arms, lacks international recognition (by noncommunist countries). The Democratic Kampuchea coalition retains the United Nations seat. But for "practical" purposes (as opposed to diplomatic purposes), the socialists are in charge. And they don't like amateur radio. So where does this tangled web of international politics leave XU1SS? Probably out in the cold.

You can't fault the XU amateurs for trying. The amateur operation is part of the international support for the many thousands of Cambodian refugees near the Thai-Cambodian border. Each day many volunteers from all over the world, including several Japanese amateurs, crossed the border with day passes, to aid in the refuges work. These Japanese hams set up an amateur station in Ampil, near the Thai border, on aptly named "Ham Avenue." The Japanese hams were restricted to daytime operation, because of their volunteer border passes, but they trained some native operators for late night contacts and to continue on the air after the Japanese returned home.

So here we have a bunch of hard-working volunteers, setting up and training hams in a much-sought-after country, working with the direct support of that country's president, and it still doesn't count for DXCC. How did we get into this ridiculous position?

We have to go back more than 10 years to come to the root of the problem. Before Don Miller got caught lying about his operating location, the ARRL DXCC branch generally assumed an amateur operation was legitimate. In other words, the operation took place from within the "country" indicated and was not against the law of that country. But after the Don Miller lawsuits, the League's DXCC gang started getting fussy about proof that the operation took place as claimed. And to avoid offending any potential votes at the WARC international frequency-allocation conference, the DXCC gang tried to avoid giving even their limited "recognition" to amateur operations that did not have the full support of the country's government. At the same time, popular sentiment has led to a change in the rules for defining what is a DXCC "country," so that individual rocks and islands don't wind up as "countries," as we had with St. Paul Island off Nova Scotia, for example.

That attitude may have been a good idea at the time, but its continued application has stifled DX. The flood of new and changing countries has slowed to a mere trickle. The fine band conditions of the past few years have brought up the DXCC totals of many amateurs to the point where new countries to work are essentially nonexistent.

This problem is not due to any lack on the amateur's part. Lack of courage in the face of unknown dangers is no obstacle, as we saw in the ill-fated attempt to activate the Spratly Islands. Nor is expense an overwhelming factor, as the DX community provided tens of thousands of dollars of support to several major DXpeditions recently. Nor have all the older DXers gone on to other activities. The XU stations generated good pileups, and many seldom-heard callsigns were in there calling. So the DXers are listening; they just don't hear much that excites them.

Japanese amateurs have been instrumental in restarting amateur radio throughout Asia, including Kampuchea. Kan Mizoguchi JA1BK was a key figure in the activation of China BY1P. (Photo via The DXers Magazine)

JA1BN's impressive shack.

A Modest Proposal

So what can we do to inject some new life into the DX world and reward the efforts of these hard-working and well-meaning amateurs, such as the XU gang, without opening wide the gates to encourage potential cheating? One way might be to initiate a "Wild Card" for DXCC. The ARRL DXCC group would have a middle ground, a third alternative to the present "accepted for DXCC credit" or "not accepted." The third alternative would be granted to operations such as the XU1SS effort, that is, to well-meaning amateur operations unquestionably within the borders of the country claimed but unable to meet full DXCC requirements. Other types of amateur operations which might fall under the same category would be times when the local authorities give verbal permission for amateur operation but won't grant a written license. Or an effort such as the 1S1CK DXpedition into the Spratly group. Each DXer would be allowed one Wild-Card confirmation each year, from the ARRL's list of eligible Wild-Card operations.

This proposal leaves the majority of the DXCC rigmarole unchanged while providing at least some incentive for amateurs on both ends of the pileup to keep trying. Any change in Honor-Roll standing or relative positions would be gradual, over a period of years. Longevity will continue to be the single most important possession for Honor-Roll status, as each year of DX activity means another potential Wild Card.

The DXCC branch should welcome the additional alternative, as it gives them an "out" in otherwise sticky situations. For example, when we wanted to win Japan's support for the IARU's WARC band proposals, the ARRL made 7J1RL, Okina Tori Shima, a separate DXCC "country" and later had to delete it. How much simpler it would have been to make 7J1RL a Wild Card! Or take the case of 4U1UN, where the League either had to eliminate 4U1ITU, in Geneva, or say a separate "country" existed in downtown Manhattan.

Will the League go for this idea? New ideas have not had a good history at 225 Main Street, especially around the DX desk. But DX sentiment is rising for some changes, serious changes, in the DXCC rules and administration. Some other possibilities are: scraping out the system and replacing it with a totally new one (over the dead bodies of many hundreds of Honor Rollers and near-HR DXers), or simply granting "DXCC-Counter" status to any well-run DXpedition, regardless of the location. Dry Tortugas? Water Island? Pribilof Islands? The League could define guidelines for *how* the DXpedition operated, without regard as to *where*. Fred Lass

K2TR would return to the sanitary landfill in the middle of Lake Ontario, where he activated WD2UMP back when the FCC issued such calls. And why not? Is this any more absurd than the system we have now? At least it would be a lot more interesting!

NOTES FROM ALL OVER

Tom Gregory TU2NW is up and running in Abidjan, Ivory Coast. Tom runs a Kenwood TS-830S with remote vfo into an Alpha amp. His antenna farm includes a KLM KT-34A at 60', a multiband vertical, and wire antennas for the lower frequencies. Look for Tom around 28555, 21300, 14155, 7070, and 3795 on SSB, and 20 kHz up for CW contacts. Tom likes contest operations and is looking for donations toward a contest keyer. Donations and QSLs must go via Mike Hayden AK3F, PO Box 573, Gettysburg PA 17325.

Don Mears KX6QO is trying to find former KX6 (Kwajalein) amateurs—both residents and DXpeditioners. Don hopes to forward some of the thousands of undeliverable QSLs piling up on Kwajalein. If you ever operated KX6, send your address to Don at PO Box 793, APO San Francisco CA 96555. Don also reminds DXers that KX6 calls with a single-letter suffix (KX6A–KX6Z) are in California, *not* Kwajalein.

Vic Rivera ZK1CG, in the Cook Islands, says he is the QSL manager for WA@QZW/6, one of the very few DX QSL managers for a stateside station! (Box 618, Rarotonga, Cook Is.)

Also out in the Pacific, Dave Patton KJ9W is knocking around the Guam area, especially in contests with Tom N7DZE. Dave hopes to hit spots such as CR9, DU, VQ9, 9V1, KH1–6, and KC6, mostly CW. QSL any contact with Dave via K9XR.

New QSL Address

BV2A—Charlie Moraller K2CM, Rt 1, Box 43, Grantsville WV 26147.

Jan Weaver N7YL handles QSLs for the following stations: T32AB, T3LAB, T3LA, VR3AR, W1DDV/C6A, C6ADV, and KA3BUJ/BR1 (1981–2). She also has logs from 1976–9 for VR1AG, VR1AF, FK8BG, and VK4FJ/LH. Jan's new address is: 2195 East Camero Avenue, Las Vegas NV 89123.

Follow-Up from Previous Columns

I asked the origin of a very funny "letter to an insurance company" bit (July). Three widely scattered DXers set me straight. The piece was part of the repertoire of Gerard Hoffnung, an English musician and humorist. Thanks to KF4AI, VE7BS, and N1BEF for the information.

Rich Kingston 7P8BC asked me to clarify some of my March column on Lesotho. Rich supplied information on only the amateur-radio activities in Lesotho; I dug up the background on the country myself. Rich writes, "Lesotho has a great potential as a tourist area with some of the most spectacular scenery in the world."

REVIEW

SHORTWAVE HOBBY EQUIPMENT REVIEW

The *Shortwave Hobby Equipment Review* is published by the International DXers Club of San Diego and is a book aimed at providing information concerning shortwave receivers and accessories to the shortwave listener. The *Review* is made up of reprints from the club's monthly bulletin and is updated by yearly supplements and quarterly updates. It's published in loose-leaf form so that updates can be added easily.

This book is unique because it attempts to deal with the technical area of receiver performance in a decidedly nontechnical way. These reviews, some written by members of the club and others reprinted from both domestic and foreign shortwave magazines, don't read like those in *QST*, or even in *CQ*.

They are more properly called user reports, and because several reports from different users are included for the most popular receivers, the book gives a good overview of the good and bad points of the equipment. There are some technical reports of receiver performance included, always with the editor's caveat that "I don't know what this means, but maybe you do."

Along with reviews, the *Review* contains modification hints (generally nontechnical), rumors about new receivers, tutorials on receivers and antennas, and the random ramblings of Larry Brockman, the president and spiritual leader of the club. The book also includes a section on RTTY "listening."

Although the emphasis of the book is on current shortwave receivers, some ham equipment with general-coverage capability is included. There is a fair amount of material covering vintage receivers, giving opinions as to good and bad models, as well as modification and spare parts info on some of the more popular boat anchors. Any book that tells where to find spare ballast tubes for an R-390A can't be all bad! Receiver preamps and preselectors also are well covered.

The non-review parts of the *Review* are in some ways the most interesting. Larry Brockman is apparently one of those fellows who's done a little bit of everything and has strong opinions about anything. I think he's a bit like Wayne Green—you either like him or hate him, but either way he's fun to read.

I don't think I can recommend this book for the ham with no interest in shortwave (as opposed to ham) receivers. There's just not enough material pertaining to ham equipment to justify the cost. If, however, you do play SWL and are interested in what the market has to offer in that area, the *Shortwave Hobby Equipment Review* may be the ticket.

For further information about the *Review* and about membership in the club, contact the *International DXers Club of San Diego, 1826 Cypress Street, San Diego CA 92154–1154.*

John Ackermann AG9V
Green Bay WI

THE ICOM IC-751 HF TRANSCEIVER

Considering the state of the integrated-circuit art, I suppose it was inevitable that an "amateur" transceiver of this complexity would be made available to hams and shortwave listeners. The Icom IC-751 HF transceiver is an incredible package of versatility, accomplishing in one unit what a few years ago would have taken an outboard microcomputer in addition to a transceiver.

As Table 1 shows, the IC-751 is really a complete amateur-band-only (including WARC bands) transceiver *and* an all-mode general-coverage receiver. In addition to what you might expect—CW/SSB/AM capabilities—there are also FM and RTTY modes along with 32 frequency/mode memory and scanning facilities, two vfo's, filters, noise blanker, passband and notch tuning, rock-solid stability, and even an optional synthesized voice to inform you of your frequency. This last feature is particularly intriguing for the visually impaired because frequency determination is probably the hardest parameter to represent non-visually.

For this review, I received the 751 and the optional IC-PS15 outboard power supply. There are a lot of options to come, says Icom, including internal power supply, external frequency controller, more filters, and other goodies. I carefully unpacked the two boxes and found that Icom had done an excellent job of protecting its products against shipping damage, and everything, including the documentation, was sealed in plastic. The 32-page instruction manual package also included some functional block diagrams and a complete schematic: a two-sided fold-out that requires a Sherlock Holmes type magnifying glass to read. But it's nice to know you have a chance of tracking something down should (dare I say it?) anything go wrong.

Band	Frequency Range (MHz)
160	1.800.0— 1.999.9
80	3.440.0— 4.099.9
40	6.950.0— 7.499.9
30	9.950.0—10.499.9
20	13.950.0—14.499.9
18	17.950.0—18.499.9
15	20.950.0—21.499.9
12	24.450.0—25.099.9
10	27.950.0—29.999.9

Table 1. Amateur-band coverage.

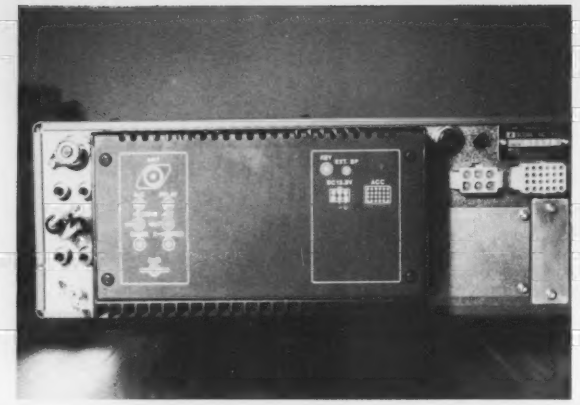
The only connections required are mike, key, antenna, ground, and power cable to the separate supply. The power supply then plugs into 115-V-ac power, and that's that. Also included is a hefty dc power cable should you decide to run the 751 directly from 12 V dc. But if battery power is contemplated, don't forget that at 200 Watts input you'll need 16–18 Amps at 12 volts.

As I perused the instruction manual, I soon found that this wasn't the sort of equipment you just intuitively know how to operate; there are over 50 operator controls, some of which function differently

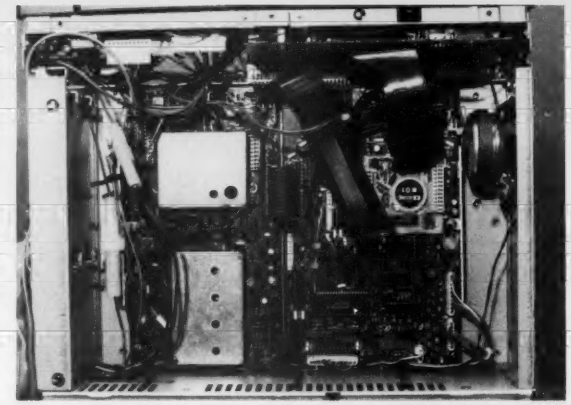
Mode	Display
USB	9.997.0
CW/RTTY	9.999.4
LSB/AM/FM	10.000.0

Table 2. 10-MHz WWV carrier frequency as displayed according to the scheme shown here.

The Icom-751 HF transceiver.



The back side of the 751. The legends identifying the connectors are much easier to read than the usual stamped-in letters. The vertical plate in the lower right is rumored to someday soon hold access to the microprocessor's address and data lines.



The underbelly of the 751. The optional internally-mounted 115-V-ac power supply mounts on the bottom cover and protrudes into the surprisingly open space.

depending on the position or setting sequence of others. But after a time of reading and experimenting and operating, most things began to make sense. I say most things because in spite of the 751's attempt to be the last word, it has some peculiarities worth mentioning. More on those later.

The 751 accommodates both the Icom IC-HM12 electret hand mike with fingertip frequency-scanning push-buttons and the IC-SM6 stand microphone. Both are wired for the 8-pin connector on the front panel. Included are a built-in speaker with very good intelligibility and a two-detent headphone jack for speaker, speaker/phones, or phone-only operation. An external speaker jack is also provided that disconnects the internal speaker when plugged in. Audio is clean, crisp, and very strong, and intelligibility seemed best to me with the TONE control at full treble.

My initial operation was with the general-coverage receiver because I figured I couldn't hurt anything by just listening. When you turn on the 751, there's a pleasant silence and the multi-purpose meter illuminates. The complex digital display is blanked for a second or two, but then with a definite relay click, the red and blue display comes to life.

The heart of the 751 is digital, including a microprocessor, and the logic is arranged so that on power-up the complex display indicates that the transceiver is in amateur (HAM) or general-coverage (GENE) mode (depending on how you last left it), vfo A is selected, and memory-channel 01 is queued up first. Ham-band coverage is confined to the band segments shown in Table 1, but general-coverage reception is continuous from 100 kHz to 30 MHz.

Operation

Suppose you wanted to check out the gang on 21.380. If you've previously programmed, say, channel 03, then you touch the VFO/M push-button and you're there. Along with the frequency, the digital display shows that you've automatically been put in USB, too. If no one is there and you want to try a favorite haunt on 15m CW, perhaps 04 in memory, a very slight twist of the main-tuning control clicks you instantly into 21.016 in the CW mode. No other controls need be touched. If 15 is dead and you want to try 40, a programmed 05 (or any other location up to 32) and another main-tuning-control twitch puts you there, along with auto conversion to LSB. A function switch enables you to change to USB or other modes if desired.

The 751 includes automatic carrier offsets for all modes—as shown in Table 2. So, when you change modes, the built-in calibration to WWV always reflects accurate carrier (or suppressed carrier) frequency. This is one of the little quirks that is kind of hard to get used to. This means that WWV on 10 MHz is displayed as 10.000.0 even when you know you are tuned off carrier frequency for AM reception. As far as mode selection goes, the amateur conventions of LSB on 7 MHz and below and USB from 10 MHz on up are followed.

If for some reason you have used up all 32 memory channels and would like to check propagation on any or all the ham bands, all you need to do is touch the BAND select push-button and turn the main-tuning control. The 751 is programmed to start near the bottom of each band, the exact location of which depends on operating mode—as shown in Table 3. A second touch of the BAND select push-button allows you to tune freely throughout the band.

When you reach, for example, the top of a band, the 751 jumps back to the bottom of the band. Similarly, when you reach the bottom of the band, the next step is back to the top of the band. When you decide to try the next higher or lower band, depress the BAND select switch and rotate the main-tuning control to click into the next band. For general-coverage applications, a similar sequence occurs, but in 1-MHz steps.

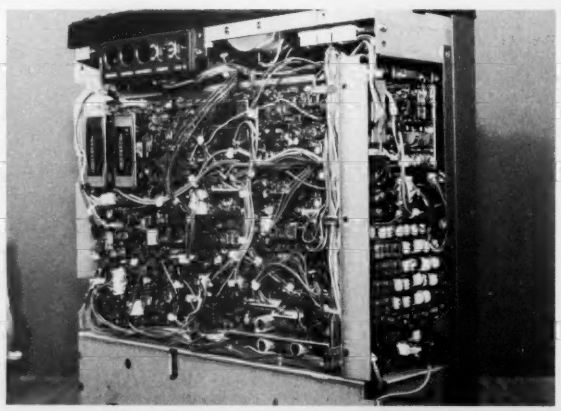
After you've made your coarse frequency selection via the BAND select push-button, you have your choice of several tuning-rate options. Slowest is about 2 kHz per rotation of the main-tuning control. If you physically tune faster, that is, spin the dial with a flick of the wrist, the tuning control automatically shifts into a faster rate—about 10 times as fast. Depressing the tuning rate push-button (labeled T S) really shifts tuning into warp drive—about 200 kHz per rotation. If all this sounds a little formidable, don't despair. You catch on rather quickly and it gives you enormous band, frequency, and tuning agility.

Because the front panel is already so full of controls and push-buttons, I guess Icom had to delegate some functions to a different geographical location—in this case, a small auxiliary panel on top of the transceiver directly above the display. Here you'll find a preamp/attenuator switch that lets you choose among straight-through, 20 dB of attenuation, or 15–20 dB of gain, as near as I could tell. The instruction manual doesn't say what the gain is, but the preamp does work well with little extra noise added in.

Also located on top are the MARKER switch and CALIBRATOR control. Because the internal logic of the 751 automatically compensates for carrier position and a central synthesizer is common to all bands, you need only dial in WWV on AM, set the display at 10.000.0 MHz, for example, and with the MARKER switch on, adjust the CALIBRATOR control for zero beat.

Unfortunately, I found this very difficult for several reasons. First, if the WWV signal is weak or exhibiting a moderate amount of QSB or flutter, the calibrate signal strength overpowers it so that it's

The non-ergonomic top-panel controls. Perhaps they are recessed because Icom knows hams love to stack equipment to the ceiling. But if you cover them up, how do you get to them?



With top and bottom covers removed, the 751 struts its stuff; it's not for the timid.

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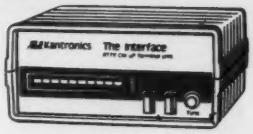

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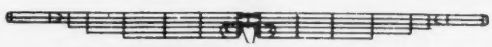

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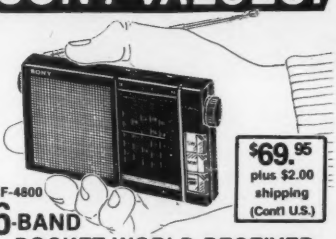

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30	10.050.0	10.049.4	10.047.0
20	14.050.0	14.049.4	14.047.0
18	18.050.0	18.049.4	18.047.0
15	21.050.0	21.049.4	21.047.0
12	24.550.0	24.549.4	24.547.0
10	28.050.0	28.049.4	28.047.0

Table 3. Displayed frequency after amateur-band selection.

tough to hear the beat note. Second, owing to the shape of the CALIBRATOR knob, it was difficult for me to make fine adjustments. I did find that by watching the S-meter fluctuations, I could zero-beat "visually" better than audibly. The little nub-like switches for the preamp and MARKER switches make it difficult to distinguish their positions, too.

Along with the preamp and calibrate controls are the MONITOR and ANTI-VOX controls, both of which are the same difficult-to-grasp shape. Luckily, these are not used often. And, in all fairness, considering the rock-solid stability of the 751, the calibrate controls won't get used much either. From early morning turn-on until late-night power off, I could detect only a very minute audible (or visual) calibration drift from WWV.

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Icom also warns against operating into a vswr greater than 2 to 1, apparently because the protection circuitry can't cope. Reduced power and antenna tuners are also suggested for problem matches. Using the 751's built-in swr meter, I managed to load up easily on 80 through 10.

Although there isn't room in this review to explain adequately all the possible memory/vfo(s)/scan permutations, it quickly became obvious that from a frequency-handling perspective, the 751 should be great for contests and DX. There are two

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vfo's, a DUPLEX switch to set them up for splits, and both receive and transmit offset provisions. Vfo's can be equalized, that is, set to each other instantly by pressing A=B, and memory frequencies and modes can be dumped into the vfo's by touching another switch.

The 751 offers a very flexible scan mode along with squelch control. Basically, you can set it to scan (top to bottom) (1) the entire general-coverage band, (2) within the limits of the frequencies set in memory positions 01 and 02, (3) all the memory channels, and (4) all the memory channels with a certain mode (such as AM) that you specify. Depending on SQUELCH control setting, the 751 will pause for about 10 seconds on every active frequency before continuing on.

All in all, I would recommend that you get hold of a 751 and do a personal evaluation. You'll need some time, though, to really explore its capabilities. And if all the options promised by Icom materialize, bring a lunch. Versatility is the watchword, and Icom has it.

For further information, contact *Icom America, Inc., 2112-116th Ave. NE, Bellevue WA 98004; (206)-454-8155.*

Gene Smarte WB8TOV
Hancock NH

LETTERS

BIG GUN, BIG MOUTH

I read your magazine almost monthly and enjoy thoroughly some of the columns, especially the DX column by Chod Harris VP2ML.

The Heard Island story of August, 1983, was enlightening and my hat is off to the crew that brought that DXpedition to fruition. What courage, stamina, and financial burden that crew endured.

I was, however, upset at the boxed story accompanying the column, "Pileup Busting—By the Experts." What the experts had to say was helpful and based on knowledgeable operating and courteous common sense—except for the comments by K8CW. I find his comments very elitist. He eliminates transceiver-equipped stations by using wide splits. I would guess that he eliminates many average hams also. He also gives the edge to the big-signal stations—antenna farms and probably big amplifiers.

Based on K8CW's elitist attitude, I don't have much of a chance to ever work the big-time DXpeditions because, at present, all I have is a transceiver and a small 3-element beam—hardly an antenna farm.

Additionally, the time K8CW spends maintaining his blacklist could be better spent making quality contacts. I find his blacklisting 180 degrees out of phase with the tenets of amateur radio. Yes, I do agree that there are some inconsiderate operators out there when it comes to DX, but wouldn't it better to educate these people to the proper way of operating so that everyone gains?

Dick Jacovino KA1YP
Waterbury CT

HAM HELP WORKS!

My request in "Ham Help" for a manual on the Knight G-30 grid-dip meter has resulted in manuals, cards, and letters. How do I get them to stop?! The response has been outstanding, indicating the mutual concern of the ham family. I would like to suggest in such instances that a card or note precede the copying and mailing of requested material. I have felt obligated to reimburse those who sent the manuals and I now have an adequate supply—plus!

James E. Smith K5PTC
Irving TX

PETER, PAUL, AND STUART

Several months ago you published a rather savage editorial criticizing the September/October, 1982, Peter and Paul expedition. I was a bit surprised, since none of the five operators had been checked for their side of the story of why the wide bandspread on 20 meters.

As the team leader, I must take full responsibility for what happened, despite the fact that I did not operate 20-meter phone when it became apparent that the situation was completely out of control. I can assure you that on my next DXpedition, I will utilize selective calling and keep the bandspread down to an extremely reasonable width.

I suspect you are not aware of the following facts:

- During the five days spent on the island, only two meals were provided by the Captain.
- Despite the equatorial location of the rocks, it was cold at night and there was insufficient foul-weather gear. The five of us crewed the vessel for five days and were exhausted when we arrived.
- The Captain refused to permit us to bring a table, so we made do with three pieces of plywood supported by loose basalt rocks for the stations. IDXF loaned us a 901 DM (which served on Spratly, 9M6, CR9, VS5, Desecheo, Navassa) and also a 101ZD which was used on Desecheo and Navassa. Both transceivers were disabled within the first four hours of operation. The band-selector shaft on the 901 snapped and one board failed. Carrier output was available but no audio and no receive could be obtained. The 101ZD received but no rf output could be obtained. Accordingly, for CW, K8CW and PY2CPU utilized a 101E belonging to K8CW and PY2BZD. N4BQW and I used a very old 101ZP with a bad front end belonging to PY2BZD.
- I had no problem working SSB and 10, 15, and 40. However, please bear in mind that the location of the rock is equidistant between Europe and the States, and despite the fact that the 101ZD had full rf attenuation, most signals were 30 over 9—no receiver can handle several hundred stations calling at the same time in a 20-kHz split. I am sure you are aware that 20-meter phone operators increasingly are using monobanders and full legal (?) limit amplifiers; many of them are using equipment without receivers. In other words, many did not listen. This created a problem for the policemen who were fighting with each other at 14.195. As soon as the operator concerned became aware of the problem and told me, I took the phone station off of 20 and put it on 40 where there was no trouble.
- A recent Pacific Island trip to a quasi-rare spot produced the same incredible band split on 10-meter phone without complaint or editorials.

K8CW need not apologize for his performance. He made 6,000 contacts as PY0ZSC and 24,000 of the total 29,000 contacts from Heard Island. I did a respectable job on Desecheo and produced 6,000 contacts on Navassa in four days. Bearing in mind the adverse conditions, hunger, illness of three operators, tides which forced us to move the stations at night, sharks between the rocks, and a medical emergency which caused N4BQW to leave the island to attend an injured Brazilian sailor on a visiting boat for a period of eight hours, frankly, I am surprised that we produced 16,000 contacts in four days. I am also surprised that, despite our repeated requests for no duplicate contacts, station after station "duped" us, including many prominent DXers.

You are free to print this letter, and I would be interested in receiving your own thoughts. I plan to operate from another needed location in the next few months and from a very badly needed country as soon as licensing formalities can be completed. I can assure you that if there is another problem on 20 meters while I am operating, I will QSY to CW or drop the operation to 40 or 80 meters.

Stuart P. Greene WA2MOE
Peekskill NY

DISTORTED REASONING

I wish to comment on the dropping of the required facility in Morse code from amateur-radio licensing requirements.

I have been a ham since April, 1982, and hold a Canadian amateur-class license. I am restricted mainly to A1 operation on the HF bands but do enjoy limited phone privileges on 10 meters. I am also allowed phone privileges on various frequences in the VHF and UHF portions of the radio-frequency spectrum.

I am concerned about the current effort, both within and without the American amateur community, to integrate a codeless amateur license within the parameters of the American licensing program.

I do not believe a codeless license will attract a substantial number of newcomers to amateur radio. Further, there seems to be a belief that theory requirements should be made more demanding in order to attract technically-inclined individuals to amateur radio.

This kind of distorted reasoning is very unhealthy for amateur radio. In studying for my licenses, the learning of radio theory presented a greater hurdle to me in obtaining an amateur license than did the required facility in Morse code.

I enrolled in a ham-club-sanctioned licensing course, attended every lecture, and diligently studied all of the assigned readings. Of 45 individuals who began the course, only 6 students were successful in obtaining their licenses—a dismal 12% success rate. Had it not been for the kind help of a very good friend, I too would have failed in my quest for that coveted "ticket."

Judging from the comments of many, hams and non-hams alike, this is not a singular experience. It illustrates clearly that problems exist in the manner in which electronics is currently published and taught.

Currently, theory is presented in an often complicated, confused, and dry manner. Efforts must be made to ensure that the theory upon which our hobby is based is available to individuals in a simpler and more attractive mode. At the same time, efforts must be made to make the learning of code less of an obstacle to potential radio amateurs.

Because code is the simplest means of radio communication, it is, by its nature, something with which all amateurs have some familiarity. Consequently, it is not unreasonable to expect prospective amateurs to display competence in its transmission.

A common thread binds all amateurs together, that being the camaraderie and fellowship which is the essence of our hobby. The theory changes proposed by eager technophiles can only hurt amateur radio, due to the basic elitism inherent in any such proposals—elitism totally foreign to the essential spirit of hamming.

We amateurs must increase involvement by the community in amateur radio. To do otherwise will ensure our hobby will continue to be trivialized in the public mind. Thus, growth in the ranks of amateur radio will be very limited.

Arthur Cramer VE4ACM
Winnipeg MAN

Well, Arthur, I'm not sure where you are reading these things—certainly not in my editorials. While I am not a fan of the Morse code, feeling that it should have been eliminated as a requirement for a license at least 50 years ago and promoted as a fun means of communication in order to retain popularity, I don't recall ever claiming that dropping the code would bring in more hams. On the contrary, I doubt if this would make a lot of difference. If we want hams, we'd better start letting teenagers know about our hobby and promoting ham clubs in high schools like we used to when the hobby was growing.

I think we should have a legitimate technical, rule, and operations exam. The material doesn't have to be any more difficult than presently required. We should have the exams given by clubs so we can get away from the memorization/Bash syndrome. You sure are right about there being a need for a better book explaining the theory, though our study manual is pretty darned good in this line. Perhaps there is someone out there who would like to write a real fun introduction to electronic and radio theory.—Wayne.

CASH OR CREDIT

One of the amateur-radio-magazine editors has been decrying the lack of interest by young students in science studies. He claims that other nations' youth are passing ours by. There is credence in his utterances.

I am aware of one individual who has arisen to inform our youth about at least one facet of science. At Junior High School No. 22 in the heart of New York City, Joseph J. Fairclough WB2JKJ has been teaching his youngsters a course in "Ham Radio English."

Joe has wall-to-wall QSL cards decorating his classroom. His students happily talk over his station situated near his desk. I

have visited the school and I have talked to the students in his classroom via amateur radio. I know that Joe has given those kids a good course in English and successfully planted the seeds of amateur radio into their fertile minds.

During my high school days I was fired with enthusiasm for ham radio by membership in the school's radio club under the trusteeship of the school's physics department. That enthusiasm never died. It had a profound effect upon my career.

Recently, as a guest of the Martinsville, Indiana, Radio Club, I proposed the installing and maintaining of high school and junior high school radio clubs in the schools of our land wherever practicable, to be trusteed by a faculty member friendly to ham radio and to be sponsored by local QCWA, SOWP, ARRL, and other amateur-radio organizations. Sponsorship would include guidance, assistance in setting up a station, and follow-up to see that the station is properly operated (not devastated in the manner of many club stations). Of course, the local sponsoring club would have to be a viable, responsive group as well.

I feel that such a program would be more effective than the cash donations now given to gifted youth.

Paul L. Schmidt W9HD
Bloomfield IN

SOCIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices, 73 Magazine, Pine St., Peterborough NH 03458.

FARIBAULT MN
DEC 3

The annual Handi-Ham Winter Hamfest will be held on Saturday, December 3, 1983, at the Eagles Club in Faribault MN. Registration will begin at 9:00 am. There will be a Handi-Ham equipment auction and a dinner at noon. Talk-in on .19/.79. For more information, contact Don Franz W0FIT, 1114 Frank Avenue, Albert Lea MN 56007.

HAZEL PARK MI
DEC 4

The 18th annual Hazel Park Amateur Radio Club Swap and Shop will be held on Sunday, December 4, 1983, from 8:00 am to 2:00 pm, at Hazel Park High School, Hazel Park MI. Tickets are $1.50 in advance and $2.00 at the door. Tables are $1.00 per foot. Hot food and plenty of free parking will be available. Talk-in on .52 simplex. For tickets and table reservations, write HPARC, PO Box 368, Hazel Park MI 48030, or phone (313)-544-2965.

WEST ALLIS WI
JAN 7

The West Allis Radio Amateur Club will hold its 12th annual Midwinter Swapfest on Saturday, January 7, 1984, beginning at 8:00 am, at the Waukesha County Expo Center Forum (take I-94 to Co. F, then south to FT, then west to Expo). Admission is $2.00 in advance and $3.00 at the door. Tables are $3.00 in advance (reserved until 11:00 am) and $4.00 at the door on a first-come, first-served basis. Delicious food will be available. For tickets or more information, send SASE to WARAC, PO Box 1072, Milwaukee WI 53201.

SOUTH BEND IN
JAN 8

A hamfest swap & shop will be held on Sunday, January 8, 1984, at Century Center, downtown on US 33 Oneway North between the St. Joseph Bank Building and the river, South Bend IN. Tables are $3.00 each in a carpeted half-acre room. The Industrial History Museum is in the same building. Four-lane highways lead to the door from all directions. Talk-in on .52/.52, .99/.39, .93/.33, .78/.18, .69/.09, 145.43, and 145.29. For more information, contact Wayne Werts K9IXU, 1889 Riverside Drive, South Bend IN 46616, or phone (219)-233-5307.

YONKERS NY
JAN 22

The Yonkers Amateur Radio Club will sponsor the Yonkers Electronics Auction on Sunday, January 22, 1984, from 9:00 am to 3:00 pm, at Lempko Hall, 556 Yonkers Avenue, Yonkers NY. Admission for buyers and sellers is $3.00 each; children under 8 will be admitted free. New and used equipment will be auctioned and can be inspected from 9:00 am to 10:00 am. There will be plenty of seats and parking and the auction will start at 10:00 am sharp. Unlimited free coffee will be available all day. The club will charge a 10% commission on the first $100 and 5% on the remainder on successful sales only. Talk-in on 146.265T/146.865R and .52 direct. For more information, write YARC, 53 Hayward Street, Yonkers NY 10704, or phone (914)-969-1053.

MANSFIELD OH
FEB 12

The Mansfield Midwinter Hamfest/Auction will be held on Sunday, February 12, 1984, beginning at 8:00 am, at the Richland County Fairgrounds, Mansfield OH. Tickets are $2.00 in advance and $3.00 at the door. Tables are $5.00 in advance and $6.00 at the door. Half tables are available. Talk-in on 146.34/.94. For additional information or advance tickets and tables, send an SASE to Dean Wrasse KB8MG, 1094 Beal Road, Mansfield OH 44905, or phone (419)-589-2415.

GLASGOW KY
FEB 25

The annual Glasgow Swapfest will be held on Saturday, February 25, 1984, beginning at 8:00 am Central time, at the Glasgow Flea Market Building, 2 miles south of Glasgow, just off highway 31E. Admission is $2.00 per person. There is no additional charge for exhibitors. The first table per exhibitor will be free, and extra tables will be available for $3.00 each. There will be a large heated building, free parking, free coffee, and a large flea market. Talk-in on 146.34/.94 or 147.63/.03. For further information, write Bernie Schwitzgebel WA4JZO, 121 Adairland Court, Glasgow KY 42141.

SIGNAL GENERATORS
RECONDITIONED AND LAB CALIBRATED

AN/URM-25 MILITARY SIG GEN, RANGE 10 KHZ THRU 50 MHZ, AM/CW, MODULATION 400/1000 HZ, CALIBRATED OUTPUT, PRECISION 50 OHM STOP ATTENUATOR $285.00

AN/URM-26 MILITARY SIG GEN RANGE 4 MHZ THRU 405 MHZ, 400/1000 HZ MODULATION, CALIBRATED OUTPUT, SMALL COMPACT SIZE $285.00

TS-510/U MILITARY SIG GEN, RANGE 10 MHZ THRU 420 MHZ, OUTPUT VOLTAGE .5V TO 1V, MODULATION 400/1000 HZ AM/CW OR PULSE, SAME AS HP-608D $345.00

HP-614 SIG GEN, RANGE 900 MHZ THRU 2100 MHZ, AM/PULSE MODULATION CALIBRATED OUTPUT, IDEAL FOR AMATEUR 1.2 GHZ, MICROWAVE OR AIRCRAFT RADIO REPAIR $345.00

SG-557/URM-52 MILITARY SIG GEN, RANGE 3.8 GHZ THRU 7.8 GHZ, AM/PULSE CALIBRATED ATTENUATOR, MILITARY EQUIVALENT TO HP-618A, IDEAL FOR SATELLITE OR MICROWAVE REPAIR $345.00

TS-418/URM-49 RANGE 400 MHZ THRU 1000 MHZ, AM/CW OR PULSE MODULATION, CALIBRATED ATTENUATOR $225.00

TS-419/URM-64 RANGE 900 THRU 2100 MHZ, CW OR PULSE MODULATION, CALIBRATED ATTENUATOR $225.00

SG-13/U AIRCRAFT VOR/ILS MILITARY SIG GEN, RANGE 108 THRU 135.9 MHZ AND 329.9 TO 335 MHZ, OUTPUT SIGNALS INCLUDE VOR, LOC AND GLIDESLOPE AND 1000 CPS, SAME AS COLLINS 479T-2, OPERATES FROM 28 VDC AT 3½ AMPS BENCH POWER SUPPLY OR AIRCRAFT BATTERY, IDEAL FOR AIRCRAFT RADIO REPAIR $285.00

SG-66/ARM-5 AIRCRAFT OMNI SIG GEN, RANGE 108 MHZ THRU 132 MHZ, CALIBRATION OUTPUT AND MODULATION IDEAL FOR ALIGNMENT OF AIRCRAFT VOR RECEIVERS, MILITARY VERSION OF ARC H-14A $245.00

JERROLD 900A SWEEP GENERATOR, RANGE 0.5 THRU 1200 MHZ, 0.5 TO 400 MHZ SWEEP WIDTH, OUTPUT FLAT .5DB TO 800 MHZ, 1.5 DB TO 1200 MHZ, BUILT-IN RF DETECTOR $325.00

MARCONI TF-1066B AM/FM SIG GEN, RANGE 10 MHZ THRU 470 MHZ, INTERNAL FM OF 1 AND 5 KHZ WITH 100 KHZ VARIABLE DEVIATION, AM MODULATION OF 1 AND 5 KHZ, CALIBRATED OUTPUT. HAS MANY EXCELLENT FEATURES $550.00

HP 608E SIG GEN, RANGE 10 MHZ THRU 480 MHZ, CALIBRATED OUTPUT, PRECISION ATTENUATOR, INTERNAL AND EXTERNAL AM, CRYSTAL CALIBRATOR $850.00

MOTOROLA T-1034 FM SIG GEN, RANGE 25-54 MHZ, 130-175 MHZ, 400-470 MHZ AND 890-960 MHZ, VARIABLE OUTPUT FROM 0.1 MV TO 100,000 MV, CALIBRATED ATTENUATOR $385.00

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367

HAM HELP

We are happy to provide Ham Help listings free, on a space-available basis. We are not happy when we have to take time from other duties to decipher cryptic notes scrawled illegibly on dog-eared postcards and odd-sized scraps of paper. Please type or print your request (neatly!), double spaced, on an 8½"×11" sheet of paper and use upper- and lowercase letters where appropriate. Also, please make a "1" look like a "1," not an "l," which could be an "el" or an "eye," and so on. Hard as it may be to believe, we are not familiar with every piece of equipment manufactured on Earth for the last 50 years! Thanks for your cooperation.

I desperately need a circuit for an automatic line-voltage compensator for my 120-V, 12-A recreational-vehicle air conditioner.

Zoltan R. Bogar W3CJM
1921 Marymont Road
Silver Spring MD 20906

My husband, William Peuser W2BBS, passed away recently and I don't know what to do with his equipment. He had a Collins 75A receiver, Heath SB-220 linear, Heath SB-401 transmitter, Vibroplex key, Triplet frequency meter, Heath VTVM, and set of headphones. If anyone would like to buy this equipment, please let me know.

Veronica Peuser
12-42 120th St.
College Point NY 11356

I would appreciate information on adding FM capability to my Yaesu FT-301D. I would also like to find a service manual for it.

Dave Mastenbrook KA7BKS
38682 Golden Valley Drive
Lebanon OR 97355

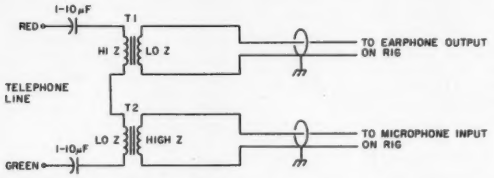
I would like to borrow a Heath IO-10 oscilloscope. I will pay the postage both ways and return it in two weeks.

Frank Aldrich N8AFZ
1094 Quince
Boulder CO 80302

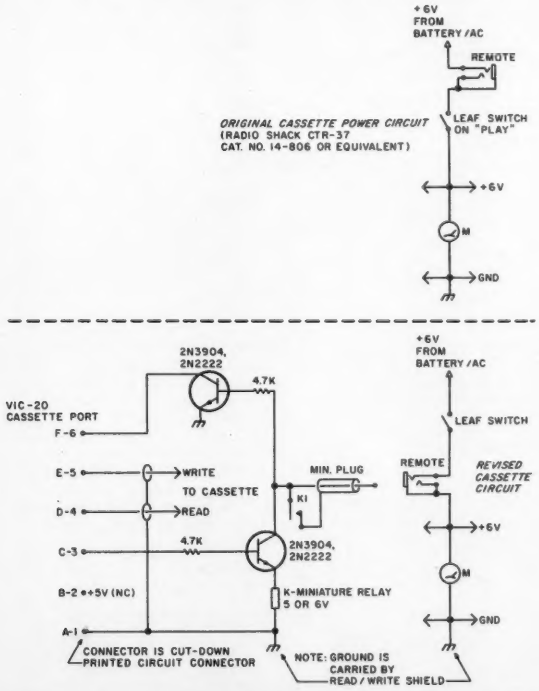
CIRCUITS

Do you have a technique, modification, or easy-to-duplicate circuit that your fellow readers might be interested in? If so, send us a concise description of it (under two pages, double-spaced) and include a clear diagram or schematic if needed.

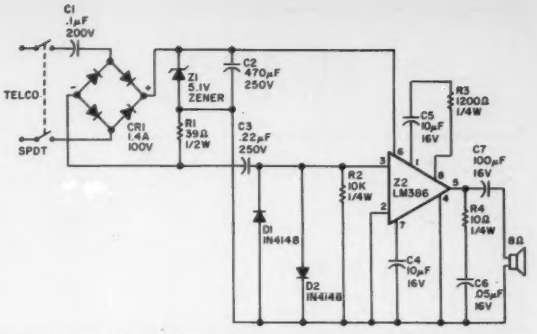
In exchange for these technical gems, 73 offers you the choice of a book from the Radio Bookshop, *to be sent upon publication. Submit your idea (and book choice) to: Circuits, Editorial Offices, 73 Magazine, Peterborough NH 03458. Submissions not selected for publication will be returned if an SASE is enclosed.*



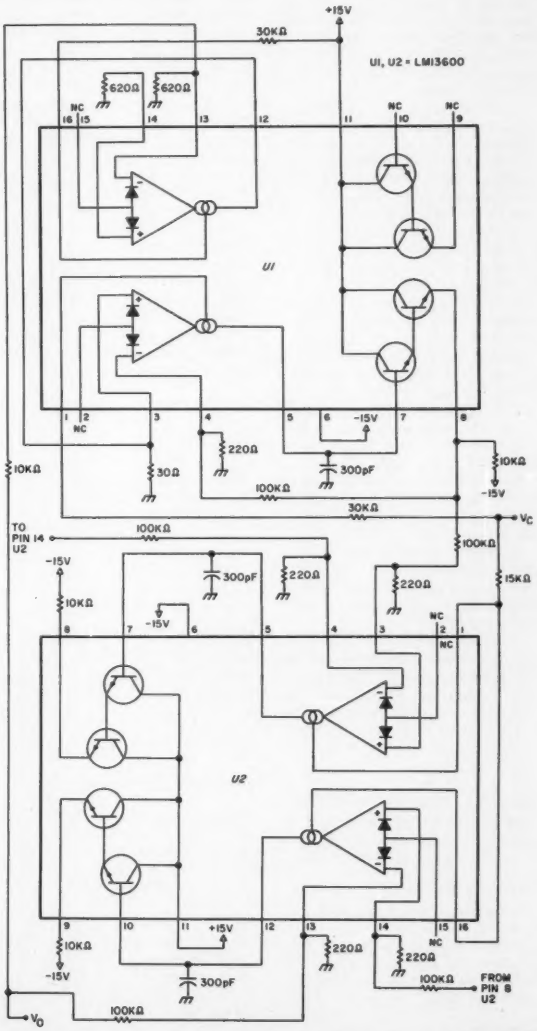
NO-COST PHONE PATCH: By scrounging two transformers from transistorized broadcast-band radios, you can make this phone patch for your HF rig. The low- and high-impedance windings were determined by using a VOM to measure the resistance; the transformers I used had about a 30:1 resistance ratio. It is possible to use VOX with this circuit if the anti-VOX is adjusted properly and the phone lines are not noisy.—Terry Fletcher WA0ITP, Ottumwa IA.



UNIVERSAL CASSETTE INTERFACE FOR THE VIC-20: This circuit will allow you to use any cassette recorder with the VIC-20, but does not prohibit normal use. To use the circuit, the recorder must be rewired so that power from the battery will go first to the leaf switch and then to the remote jack. The circuit is not critical and in operation, the normal "save," "verify," "search," and "load" commands apply.—George W. Allen N1BEP, Old Greenwich CT.



TELEPHONE LINE MONITOR: Using rectified audio as a power supply, this monitor will put the telephone-line audio into an 8-Ohm speaker. All of the parts are available from Radio Shack.—E. C. Sherrill W5TPP, Fort Worth TX.



SINUSOIDAL VCO: Using two National Semiconductor LM 13600N dual transconductance amplifier chips, this circuit provides a variable frequency output dependent on the input voltage. The circuit's frequency range is from 5 Hz to 50 kHz with a total harmonic distortion of less than 1 percent.—Paul F. Cavanaugh N2DLV/G5EHU.

AWARDS

Bill Gosney KE7C
Micro-80, Inc.
2665 North Busby Road
Oak Harbor WA 98277

WASHINGTON TOTEM AWARD

The Washington Totem Award was initiated in 1973 by the Western Washington DX Club, thus becoming the first major W7 award available to the amateur community. It used as its motif the colorful totem pole, symbolic of the Indian culture of the Pacific Northwest.

The first award was issued to 9X5NA; to date, 133 awards have been issued to 61 DX countries. To qualify:

Applicants must submit proof of QSOs with 100 different Washington stations. Twenty (20) of these must be confirmed contacts with different Western Washington DX Club members. DX stations need only confirm twenty-five (25) Washington stations including ten (10) WWDXC members.

General certification rules apply. Submission of QSL cards is not required. Cards may be checked and certified by an officer of any recognized club or society. DX stations may submit log data in lieu of QSL card confirmation.

To be valid, all contacts must have been made January 1, 1973, or later.

Certified lists submitted must be in alphabetical order, with date and time in GMT.

The Washington Totem Award is free to all stations outside the United States. US stations must include an application fee of $1.00. If QSL cards are sent to WWDXC for checking, sufficient postage for their safe return must be included with the application and confirmation list.

Special endorsements will be issued for specific band or mode accomplishments if all supporting information is included with the application.

The WWDXC will furnish a current membership listing upon request (and SASE). Mail all inquiries to: Awards Manager, WWDXC, Inc., PO Box 224, Mercer Island WA 98040, USA.

I might hint to our readers wishing to seek this award that members of the Western Washington DX Club sponsor three DX nets daily. To be part of the "W7PHO Family Hour," tune to 14.225 MHz at 1400 and 2300 GMT and to 21.320 MHz at 0000 GMT daily.

BOEING AWARDS PROGRAM

The BEARS offer quite an array of incentives for parchment pursuers. Let's take a closer look at each one individually:

Worked Five Bears Award

This award is offered for those stations confirming contact with at least five (5) members of the Boeing Employees' Amateur Radio Society. There are no band, mode, or time restrictions. General certification rules apply.

Worked Three Bear Cubs Award

Issued specifically to any station confirming contact with at least three (3) Novice members of the Boeing Employees' Amateur Radio Society. There are no band, mode, or time restrictions. General certification rules apply.

Zone 3 Award

This award is offerd in four (4) levels of operating achievement:

Basic Zone 3 Award. This award is issued to those stations submitting written evidence of having worked an amateur in each state and Canadian province in Zone 3. These geographical limits would include Arizona, Oregon, California, Nevada, Utah, Washington, and the province of British Columbia. Contacts may be made in any amateur band and mode and must have been made on or after January 1, 1984.

Master Zone 3 Award. Applicant must follow the same rules as stated for the Basic Award with the exception that all contacts must be made with a station located in the capital city of each state and province in Zone 3.

Special Zone 3 Award. This special award recognition requires the applicant to work five (5) Zone 3 stations whose last call letters spell the word BEARS. All other rules for the Basic Zone 3 Award apply.

Extra Zone 3 Award. This award combines the difficulty of both the Master and Special awards and undoubtedly becomes the most sought-after in the Zone 3 program. To qualify, contacts must be made with stations located in capital cities of Zone 3 state and provinces. In addition, the last letters of their calls must spell the word BEARS.

All awards offered by the BEARS are available free of charge. Applicants must make a self-prepared list of required contacts, including the city and state of each amateur contact claimed, the date of each QSO, the band, and the mode. This list must be verified by at least two (2) amateurs, Technicians or above, an officer of an active radio club, or a notary public. In each case, the applicant must have written confirmations on hand for each contact claimed. Submit your award application to: The Boeing Employees' Amateur Radio Society, Willis Propst K7RS, 18415 38th Avenue, South Seattle WA 98188.

SRAL AWARDS

The Finnish Amateur Radio League award manager writes to inform us about the beautiful OH series of awards being offered by this dedicated organization in northern Europe.

All applications must be forwarded to the attention of the SRAL Award Manager, PO Box 306, Helsinki 10, Finland; it is suggested that QSL cards not be sent. Instead, claimed contacts should be verified locally by two licensed amateurs, a club official or a notary public.

To be valid, all contacts qualifying for the OH-series awards must have been made since June 10, 1947. The OH awards consist of the following:

OHA

Applicants in Denmark, Norway, and Sweden need contacts with at least 50 different OH stations, including 8 OH call areas on one band, plus 8 different OH call areas together on other band(s).

Other European applicants need contacts with at least 20 different OH stations, including at least 7 OH call areas. The maximum number of contacts per band is 15, so at least two different bands must be used.

Non-European applicants need contacts with 15 different OH stations, including at least 5 OH call areas on any band or combination of bands. Contacts made on 3.5 MHz will count for two contact points.

CW, phone, or mixed-mode contacts count. The minimum acceptable reports are 338 RS(T). Contacts with Finnish maritime mobile stations do not count.

The award fee is 5 IRCs, to be sent with each application.

The OH8 stations with suffixes ND, NJ, NS, NV, NX, OA, OB, OC, OG, OI, ON, OP, OQ, OR, OU, OX, OZ, PA, PB, PD, PF, PL, PM, and PQ are counted as OH9 stations if the contacts occurred before June 1, 1954.

OHA-100

The applicant must have worked at least 100 different OH stations, including all 10 call areas on one band plus (again) all 10 OH call areas on another (one) band. The 100 stations must all be different, but in order to meet the call-area requirement, the same station may be worked on different bands; in this case, the total number of contacts will be over 100. All authorized bands may be used, as well as CW, phone, or both.

The application list must be in district and alphabetical order (only callsigns and dates), giving separate declaration of the required 2 × 10 call areas/bands.

See also paragraphs 4, 5, and 6 of OHA rules above.

OHA-300

The applicant must have worked and confirmed at least 300 different OH stations, including all 10 OH call areas separately on each of three bands, i.e., 3 × 10 OH districts. The 300 OH stations must be all different, but in order to meet the call-area/band requirement, the same OH station may be worked on different bands. In this case, the number of QSOs will exceed 300. All bands, CW, and/or phone may be used.

This application list must be in district and alphabetical order (only callsigns and dates), giving separate declaration of the required 3 × 10 districts/bands.

OHA-500

This award will be available to any foreign applicant for confirmed contact with 500 different OH stations, regardless of time, mode, or band used. For OH applicants, only contacts made since February 1, 1967, will count.

A list of the 500 OH QSL cards on hand must be submitted to the awards manager. As with all OH-series awards, this list must be verified by at least two amateurs, a club official, or a notary public. The award manager reserves the right to call for any QSL to be submitted in support of any claim. This list must be written in alphabetical order by callsign, and no other details are necessary.

The OHA-500 is given to qualified applicants free of charge, compliments of SRAL.

VK TERRITORIES

Territory	Call Area	QSLs Required
Australian Antarctica Heard Island Macquarie Island	VK0	1
Australian Capital	VK1	1
Lord Howe Island State of New South Wales	VK2	3
State of Victoria	VK3	3
State of Queensland Thursday Island Willis Island	VK4	3
State of South Australia	VK5	3
State of Western Australia	VK6	3
Flinders Island King Island State of Tasmania	VK7	3
Northern Territory	VK8	1
Admiralty Islands Bougainville Island Christmas Island Cocos Islands Nauru New Guinea New Ireland Norfolk Island Papua Territory	VK9	1

Table 1. In areas above where more than one confirmation is required, contacts may be made with any or all of the territories grouped together. VK9: Where a territory is no longer under Australian jurisdiction, contacts up to the date of independence will be accepted.

WIA AWARDS

From down under, the boys at the Wireless Institute of Australia were kind enough to present the entire portfolio of WIA-sponsored achievement awards. We will review the well-known Worked All VK Call Areas Award.

This award is offered by the WIA as tangible evidence of the proficiency of overseas amateurs in making contacts with the various call areas of the Commonwealth of Australia.

The award may be claimed by any amateur in the world who is a member of an affiliated society of the IARU, but no Austra-

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4 Memories	200 W. PEP (160M-12M)
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2304 MODEL #1 KIT BASIC UNIT W/PREAMP LESS HOUSING & FITTINGS **$19.95**
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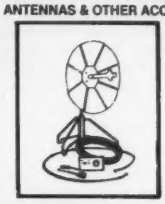

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PRE-SCALER KITS

HAL 300 PRE .....(Pre-drilled G-10 board and all components) **$14.95**
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HAL 600 A/PRE .....(same as above but with preamp) **$39.95**

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HIGHLY STABLE DECODER KIT. COMES WITH 2 SIDED, PLATED THRU AND SOLDER FLOWED G-10 PC BOARD, 7-567's, 2-7402, AND ALL ELECTRONIC COMPONENTS. BOARD MEASURES 3-1/2 x 5-1/2 INCHES. HAS 12 LINES OUT. ONLY **$39.95**

NEW—16 LINE DELUXE DECODER **$69.95**

DELUXE 12-BUTTON TOUCHTONE ENCODER KIT UTILIZING THE NEW ICM 7206 CHIP PROVIDES BOTH **VISUAL** AND **AUDIO** INDICATIONS! COMES WITH ITS OWN TWO-TONE ANODIZED ALUMINUM CABINET MEASURES ONLY 2¾"x3¾" COMPLETE WITH TOUCH-TONE PAD. BOARD, CRYSTAL, CHIP AND ALL NECESSARY COMPONENTS TO FINISH THE KIT. **PRICED AT $29.95**

NEW—16 LINE DELUXE ENCODER **$39.95**

HAL ECD—16 LINE DELUXE ENCODER INCLUDES PC BOARD, ALL PARTS & CASE **$39.95**

HAL ECD—12 LINE DELUXE ENCODER COMPLETE WITH PC BOARD, ALL PARTS & CASE **$29.95**

ACCUKEYER (KIT) THIS ACCUKEYER IS A REVISED VERSION OF THE VERY POPULAR WB4VVF ACCUKEYER ORIGINALLY DESCRIBED BY JAMES GARRETT, IN QST MAGAZINE AND THE 1975 RADIO AMATEUR'S HANDBOOK **$16.95**

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BUY BOTH THE MEMORY AND THE KEYER AND **SAVE**
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PRE-AMPLIFIER

HAL-PA-19 WIDE BAND PRE-AMPLIFIER, 2-200 MHz BANDWIDTH (–3dB POINTS). 19 dB GAIN
FULLY ASSEMBLED AND TESTED $8.95

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FULLY ASSEMBLED $12.95

NEW!

CLOCK KIT—HAL 79 FOUR-DIGIT SPECIAL—$7.95. OPERATES ON 12-VOLT AC (NOT SUPPLIED) PROVISIONS FOR DC AND ALARM OPERATION.

6-DIGIT CLOCK•12/24 HOUR

COMPLETE KIT CONSISTING OF 2 PC G-10 PRE-DRILLED PC BOARDS, 1 CLOCK CHIP, 6 FND COMM. CATH. READOUTS, 13 TRANS., 3 CAPS, 9 RESISTORS, 5 DIODES, 3 PUSHBUTTON SWITCHES AND INSTRUCTIONS. DON'T BE FOOLED BY PARTIAL KITS WHERE YOU HAVE TO BUY EVERYTHING EXTRA. WILL RUN OFF ANY 12-VOLT AC SUPPLY. **PRICED AT $12.95**

CLOCK CASE AVAILABLE AND WILL FIT ANY ONE OF THE ABOVE CLOCKS. REGULAR PRICE . . . $6.50 **BUT ONY $4.50 WHEN BOUGHT WITH CLOCK.**

SIX-DIGIT ALARM CLOCK KIT FOR HOME, CAMPER, RV, OR FIELD-DAY USE. OPERATES ON 12-VOLT AC OR DC, AND HAS ITS OWN 60-Hz TIME BASE ON THE BOARD. COMPLETE WITH ALL ELECTRONIC COMPONENTS AND TWO-PIECE, PRE-DRILLED PC BOARDS. BOARD SIZE 4" × 3". COMPLETE WITH SPEAKER AND SWITCHES. IF OPERATED ON DC, THERE IS NOTHING MORE TO BUY*
PRICED AT $16.95

*TWELVE-VOLT AC LINE CORD FOR THOSE WHO WISH TO OPERATE THE CLOCK FROM 110-VOLT AC **WHEN PURCHASED WITH CLOCK KIT $2.95**

SHIPPING INFORMATION: ORDERS OVER $25 WILL BE SHIPPED POST-PAID EXCEPT ON ITEMS WHERE ADDITIONAL CHARGES ARE REQUESTED. ON ORDERS LESS THAN $25, PLEASE INCLUDE ADDITIONAL $2.00 FOR HANDLING AND MAILING CHARGES. SEND 20¢ STAMP FOR FREE FLYER.

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lian amateur will be eligible.

A handsome certificate will be awarded to any applicant who makes contacts with Australian amateur stations in the areas shown in Table 1. A total of 22 contacts must be made.

Contacts between overeas stations and Australian stations must have been made on or after January 1, 1946.

Contacts may be made using any authorized frequency band or type of emission permitted to Australian amateurs, but crossband contacts will not be allowed.

No contacts made with ship or aircraft stations in Australian territories will be eligible, but land-mobile or portable stations may be contacted provided the location at the time of contact is shown on the confirmation.

The applicant must submit proof in the form of QSL cards or another form or written evidence confirming two-way contacts have been made. Such verification must show the date and time of contact, call of the station worked, type of emission and frequency used, signal reports, and location (portable or land mobile stations only) of the stations contacted.

If the applicant is a member of a society which has a reciprocal agreement with WIA to verify claimed contacts for its members, submit your QSLs to that society, being sure to enclose sufficient postage fees for their safe return.

Applicants should submit their certified list of contacts and/or list of contacts with QSL cards to: the Federal Awards Manager, WIA, Postbox 150, Toorak, Victoria 3142, Australia. There is no fee for the award—it's compliments of WIA.

MARK TWAIN SPECIAL-EVENT STATION

The Connecticut DX Association will operate special-event station KO1R from 1300Z to 2000Z on Saturday, December 3, 1983, from the home of Mark Twain, The Mark Twain Memorial, in Hartford, Connecticut. The frequencies for both phone and CW will be the lower portion of the General and the upper portion of the Advanced bands. For a full-color QSL, send your QSL and SASE to: Connecticut DX Association, PO Box 181, Columbia CT 06237.

EVERGLADES ARC NATIONAL PARK SPECIAL-EVENT STATION

The Homestead, Florida, Everglades Amateur Radio Club will be operating special-event station W4SVI from 1300 UTC December 3 to 2200 December 4, 1983, in celebration of the 36th anniversary of Everglades National Park.

Operations will be 10 kHz up from the lower edge of the 40–10-meter General phone bands and Novice bands. W4SVI will also be on 146.52 MHz. A special certificate is available for a QSL and large SASE. Mail it to: W4SVI, c/o Dick Dowst WB4HZK, Everglades ARC, 14511 SW 287 St., Leisure City FL 33033.

HEN HOUSE GANG CHRISTMAS SPECIAL

W1FHP and the Hen House Gang of Bethlehem, Connecticut, will have its annual Christmas special from November 26, 1983, to January 7, 1984. They will be spreading Christmas cheer to children of all ages by relaying messages to Saint Nick. Operating frequencies will be on all bands from 40 to 10 meters. QSLs should be sent to the *Callbook* address with a 20-cent stamp.

NEW PRODUCTS

DC INSERTER FOR BLOCK DOWNCONVERTERS

The model 4408-FM/FF is used to block or insert dc power into a TVRO system downconverter. Operating frequency range is 220 MHz to 720 MHz.

When placed between the receiver and downconverter, dc power can be sent through the center coax conductor. Model #4408 comes with type F connectors, one male and one female, and you can specify a male or female input connector. Impedance is 75 Ohms, and the maximum insertion loss is 0.5 dB. Minimum insertion loss is 14 dB.

For more information, contact *Microwave Filter Co., Inc., 6743 Kinne Street, East Syracuse NY 13057; (800)-448-1666.* Reader Service number 480.

PACKET-RADIO TERMINAL NODE CONTROLLER

GLB Electronics has announced the Model PK1 low-cost TNC for packet radio. This unit has a self-contained modem and requires a 12-volt power supply, a data terminal, and a radio transceiver for packet operation. The data terminal can be a personal computer, a "dumb" terminal (keyboard and display), or even a mechanical teletype machine. The terminal interface is RS-232 compatible and self-adapts to ASCII or Baudot at data rates ranging from 45 to 9600 baud. An adapter is available for converting mechanical teletype machines to the RS-232 interface.

On the radio-link side, standard Bell 202 tones are used, with a data rate of 1200 baud, making it compatible with Vancouver and Tuscon TNCs.

Utilizing a Z80A microprocessor, the Model PK1 has 8K of ROM and 4K of RAM as standard equipment. RAM can be readily expanded to 14K, using 2K "byte-wide" memory chips, and to 56K via modification using 8K chips. The VADCG protocol is available now, and AX.25 is to be released by the end of the year. Conversion to AX.25 is accomplished by means of exchanging ROMs at nominal cost.

The unit is ready to operate on power-up with a few simple commands, but there are over 50 total commands available for control and to set operating modes and parameters. Included are ways to operate in connected and unconnected modes and even to create custom protocols via a host computer. A CW identifier is also included.

In the "Queue-up" mode, messages or data are automatically stored in internal memory. They can then be taken one at a time or all at once at the operator's convenience. A "Block" mode is available for interfacing to a host computer, where all data is transferred via a counter, permitting unrestricted flow of data having arbitrary byte values and sequences. Numeric values can be set to decimal, hex, octal, or binary with or without leading zeros. Console echo is optional, as is automatic line feed, a terminal width limit, and automatic null insertion.

Besides information, display output optionally includes non-info data, packet headers, error indications, and current link status. Each of these fields can be independently disabled or enabled. So the user may choose anything from "pure" data to all the workings of the packet environment. Each field is uniquely identifiable by machine, simplifying automatic operation controlled by a host computer.

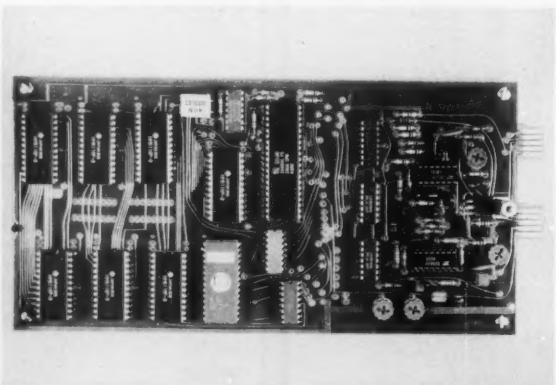
Applications include conversations, message handling, file transfers, automatic bulletin boards, etc.

The PK1 can be used as a "private" message-handling system in conjunction with a teletype machine. When a message is available it activates the motor, prints the message(s), and shuts off automatically. A user can select all-channel activity, messages from a specific station, or only those messages intended for him to be displayed.

The Model PK1 is a printed-circuit assembly, measuring 4.5 × 9.4 inches, including two 10-pin edge connectors. Power required is a single +12-volt supply at 1/4 Ampere. Connecting cables are also available.

For more information, contact *GLB Electronics, 1952 Clinton St., Buffalo NY 14206; (716)-824-7936.* Reader Service number 477.

The 4408-FM/FF dc inserter from Microwave Filter Co.



GLB Electronics' Model PK1 TNC.

HUSTLER 440-MHZ FIXED-STATION VERTICAL

The new G6-440 delivers 6 dB gain in an omnidirectional pattern with the major lobe at the horizon, making it ideal for repeater use. The stack of 5/8-wave vertical radiators is sealed in a white fiberglass radome for all-weather use. Mounting support is aluminum with stainless-steel hardware. No tuning is required, since resonance is factory adjusted to 440 MHz with a bandwidth of 18 MHz under 2:1 vswr.

For more information, contact your local dealer or write *Hustler, Inc., 3275 North B Avenue, Kissimmee FL 32741.* Reader Service number 486.

MAXCOM ANTENNA MATCHER

The Maxcom antenna matcher will tune a dipole or longwire antenna configuration, from .3 MHz to 70 MHz, with a vswr of less than 1.5 to 1.

The small size and weight of the matcher makes Maxcom ideal for land, marine-base, and avionics applications. Originally developed for military applications, the broadband coverage provides the user with one antenna for operation on many frequencies, thus eliminating multi-antenna dipole and longwire installations which not only are unsightly but also, in most cases, interact due to space restric-

tions. Maxcom is small, lightweight, efficient, and almost invisible in comparison.

When used in a dipole configuration, each leg of the dipole must be at least 35 feet long. Changes in angle and elevation will alter the directivity but will not affect Maxcom's ability to match the antenna. Inverted-V configurations have proven to be the preferred installation with Maxcom.

Longwires may also be used, provided that a substantial ground is connected to the correct terminal on the Maxcom. The Maxcom is particularly well suited for sloper configurations.

For additional information, contact *Magnum Distributing Inc., 1000 S. Dixie Highway W. #3, Pompano Beach FL 33060; (305)-785-2002.* Reader Service number 483.

MFJ-103 24/12-HOUR DIGITAL CLOCK

The MFJ-103 is a new 24/12-hour, solid-state, digital clock. It features blue, 0.6-inch vacuum fluorescent digits. This new clock has a battery backup to keep the clock on time during power outages. It requires a single 9-volt battery (not furnished).

It has an ID timer that alerts you every 9 minutes after you tap the ID/snooze button. This 9-minute timer gives you a full minute after the timer sounds to indentify and still be legal. It has a switchable seconds readout for accuracy. It can be synchronized with WWV.

The MFJ-103 has an alarm for schedule reminder or wake-up use. An alarm indicator tells you when the alarm is on.

For "observed-time" timing, just start the clock from zero and note the ending of the event up to 24 hours. It has fast and slow set buttons for easy setting and a lock function to prevent mis-setting.

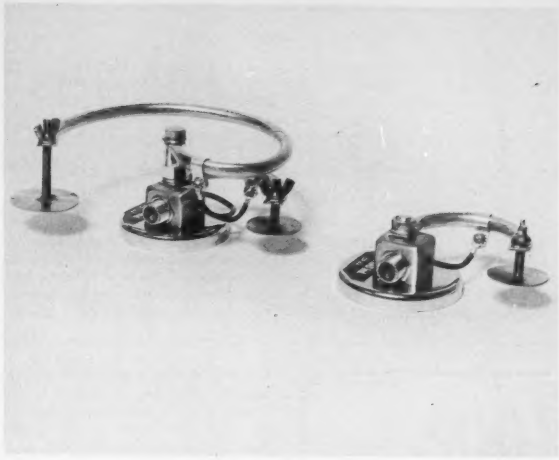
The clock operates on 110 V ac, 60 Hz, and is UL approved. The handsome, black plastic case with clear front measures 5 × 2 × 3 inches.

MFJ provides a 30-day money-back trial period. If you are not satisfied, you may return it within 30 days for a full refund (less shipping). MFJ also provides a one-year limited warranty.

For additional information, contact *MFJ Enterprises, Inc., PO Box 494, Mississippi State MS 39762.* Reader Service number 476.

DAIWA LA2155 150-W 2M LINEAR AMPLIFIER

Daiwa has introduced a new, high-power two-meter linear amplifier—the LA2155. The LA2155 delivers a 150-Watt



Com-Rad Industries' CR2/4A and CR4A antennas.

The new MFJ-103 24/12-hour digital clock.

punch with 25 Watts of FM, SSB, or CW input. The unit features an array of extras such as a switchable receive preamp, a high/low power option, fast acting protection circuitry, rf-activated transmit/receive switching with time delay and manual override option, and relative power output metering.

The LA2155 requires 12 V dc at 24 Amps maximum. For more information contact: *MCM Communications, 858 East Congress Park Drive, Centerville OH 45459; (513)-434-0031.* Reader Service number 478.

HEADLIGHTS

Headlights is a new portable light source for the repairman, handyman, and hobbyist, now available from Fogg and Egan. It directs bright light where you look while leaving both hands free to work. They light when you put them on, and there are no switches, wires, or battery packs. Headlights is designed to be worn with or without glasses. Two bulbs, 6 inches apart, flood the work area and are more effective than a single bulb in eliminating shadows in confined areas.

Headlights is ideal for times when the power is out, close-tolerance work, working in confined areas, reading in dim light, or performing any task where you need both hands free.

For more information, contact *Fogg and Egan, 17 Verdin Drive, New City NY 10956; (914)-634-5870.* Reader Service number 482.

COM-RAD'S 440-MHZ DDRR

Com-Rad Industries has added a 440-MHz DDRR to round out its family of rugged, low profile, flutter-free antennas for VHF and UHF service. The 440 unit is only 1-1/2 inches high and is made entirely from stainless steel and chromed brass (as are the units for 144 MHz and 220 MHz). The 440-MHz (CR4A) or the 220-MHz (CR3A) can be combined with the 144-MHz (CR2A) to form a two-band automatic bandswitching antenna using just one feedline.

These combination antennas are very useful when using the new dual-band transceivers that are coming on the market. Also, because of the low profile, the antennas can be mounted on the roof of a vehicle for maximum efficiency and a more uniform radiation pattern than is possible from a trunk or bumper. Both the 440-MHz and the new combination units incorporate the new capacity-disk tuning system which gives them an even lower profile and greater durability.

For additional information, contact *Com-Rad Industries, 1635 West River Parkway, Grand Island NY 14072; (716)-773-1445.* Reader Service number 484.

LARSEN TEST MOUNT ADAPTER

The new Larsen Electronics test mount adapter simplifies tracing problems in antenna or radio. It can check the antenna-feedline vswr and the radio power output at the same time. All you have to do is screw the adapter on the mount and apply a dummy load. Then check the coax, mount impedance, and connections.

The test mount has other uses as well. When you don't have clearance for a full antenna or just want to remote an antenna temporarily, you can use the adapter for a coax extension.

The test adapter is available for Larsen's NMO and NLA series mounts. For more information, contact *Larsen*

The Daiwa LA2155 150-Watt 2-meter linear amplifier.

Headlights portable light source from Fogg and Egan.

Electronics, PO Box 1799, Vancouver WA 98668; (206)-573-2722. Reader Service number 479.

NEW MODS FOR KENWOOD TRANSCEIVERS

International Radio, Inc., formerly Users International Radio Club, has released several modification kits for Kenwood transceivers.

The TS-930S 2.1-kHz cascade kit features two 8-pole crystal filters, two diode-switching boards, all parts, and instructions. This kit does not require removal of the large signal-unit PC board. All soldering is done from the top of the PC board, and no insertion loss will be noted. The filter will increase your selectivity at 6 dB from 2.7 kHz to 2.0 kHz, and from 4.0 kHz to 2.5 kHz at 60 dB.

The TS-430S cascading kit will add another 8 poles of filtering for a total of 16 poles. The added filter is patched in before the product detector and is in the receive mode only. The kit will improve your noise-floor figures and front-end dynamic range and increase selectivity. The kit consists of a pre-wired, tested PC board with a 2.1-kHz filter installed and complete instructions.

The Magicom speech processor will increase the average signal power to the antenna by as much as 6 dB. In addition, a significant "talk-power" improvement will be realized over existing processing methods used in the TS-430S. The processor comes wired, tested, and with complete instructions and pictorials.

For more information on these and other products, contact *International Radio, Inc., 364 Kilpatrick Avenue, Port St. Lucie FL 33452.* Reader Service number 481.

WHAT DO *YOU* THINK?

Have you recently purchased a new product that has been reviewed in *73*? If you have, write and tell us what *you* think about it. *73* will publish your comments so you can share them with other hams, as part of our continuing effort to bring you the best in new product information and reviews. Send your thoughts to Review Editor, *73: Amateur Radio's Technical Journal*, Peterborough NH 03458.

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Pikesville MD 21208

Well, it's December—time for our annual shopping spree. Last year, I used the pages of *73* as an avenue of shops. Your response to this approach was so good that I think we will do it again. I would like to preface this with the note that, unlike those reviews I have written about equipment tested or evaluated here at WA3AJR, the material presented this month is basically what the manufacturer claims, without much in the way of screening. I shall provide the addresses of companies for you to contact directly, should you be interested in any of the items mentioned. Since they all are *73* advertisers, I am sure the magazine will stand alongside you as well.

That said, let's take a stroll down *73* Boulevard. We are only going to look at those advertisers who directly address the RTTY crowd, even though antennas, receivers, and the like may be important. With the proliferation of RTTY equipment being offered, I think it is important to spotlight that stuff! Also, we will be using the October, 1983, issue of *73* as a guide. So, if your favorite advertiser was not there, we may miss him.

How about a copy of the 1984 *Radio Amateur Callbook*? Selling for $19.95, this is an indispensable aid to any active amateur. The book contains, besides the expected listing of all amateur callsigns, call changes, silent keys, census data, QSL bureaus, and more. A buck less buys you the international edition with information on almost a half million amateurs worldwide. No ham should be without one!

The Ham Shack takes a page to announce AEA's CP-1 Computer Patch Interface. This little box patches many popular home computers to run both RTTY and CW. It appears to offer both fixed-170-Hz and variable shift, automatic threshold, and a built-in AFSK generator. Looks interesting—it might answer the need of quite a few hams looking to interface their small computer with amateur radio.

Our old buddies at Microlog, here in Maryland, have a two-page spread to announce their version of the home computer-RTTY interface. Their AIR-1 is a single-board terminal unit and operating system that converts a VIC-20 to run RTTY and CW. Now why they chose the VIC-20, with its 22-character line, is beyond me—it would seem as though this would limit one's communication of most forms of RTTY—but they did. I would rather have seen an Atari or the like; maybe they will come out with one for that system. But for this one, they have an impressive package, display notwithstanding. Text buffer, autostart, WRU (who are you?) mode, diddle, and even a real-time clock are some of the features. This package, retailing for $199, is something to be dealt with.

Software is in abundance, and the W. H. Nail Company is advertising a disk for the Apple II with a program named Egbert II. This program allows RTTY, CW, or TDD (deaf TTY on telephone) with a software terminal unit. At $59.95, $39.95 if RTTY only is desired, this sounds like quite a bargain. Would be interested to hear from any readers who have used the program.

Macrotronics, a company that entered the computer-RTTY market rather early, offers their Terminall, a hardware and software system which sends and receives RTTY and CW on a TRS-80 Model I or III (4?), Apple II (IIe?), or Atari 400/800 (1200/1400/1450?). The box sells for $499 and is all you need other than a transmitter and a receiver to put these computers on the air.

Another old friend, MFJ Enterprises, Inc., offers their RTTY/ASCII/CW Computer Interface. Using available software, this is a demodulator and AFSK generator that will act as the hardware interface between your radio equipment and, in their words, a VIC-20, TRS-80C, Atari, TI-99, Commodore 64, or almost any other personal computer. Remember now, this does *not* include the software to turn your computer into a terminal, just the decoding of the audio from your receiver into tones and the encoding of your RTTY pulses into a form that your transmitter will accept. Nonetheless, at $99.95, it may be just the thing for the individual without adequate hardware.

Speaking of sources of software, Kantronics features a full line of programs along with hardware interfaces. Their original interface is a demodulator and AFSK encoder and sells for $169.95. Their new Interface II features a hotter front end, scope outputs, and a bunch of standard shifts. This new one sells for $269.95. In terms of software, Kantronics offers three programs which run with their own, or other (like the MFJ unit above), hardware. The basic Hamsoft program puts many popular computers on RTTY and CW with a full range of features. It is supplied on a ROM board for the VIC-20 ($49.95), Atari ($49.95), TRS-80C ($59.95), or TI-99/4A ($99.95). A disk version is also available for the Apple for $29.95. An advanced version, Hamtext, is available for the Apple, Commodore 64, and VIC-20. This features disk transmit and save modes, printer outputs, and more and sells for $99.95. Also available is Amtorsoft, one of the first programs to run the new AMTOR mode we discussed last month. Running on the same three systems as Hamtext, it sells for $89.95. Looks like an impressive line.

Okay, here comes the other printed material I mentioned. I am about to make my yearly pitch to subscribe to *73*; those of you who presently subscribe may skip to the next paragraph. Do you know how many articles have been published on RTTY in *73*? More than in any other magazine—even more than all of them combined! Yes, this magazine is ideal for keeping up with new knowledge, and at $19.97 (I don't know why the strange number, either—but then when this magazine was first published it went for 37 cents), a year's subscription remains one of the biggest bargains around.

Yet another computer interface is being offered by Contempory Technology, Inc. Their TMC-18 RTTY/CW interface appears to be a demodulator/AFSK keyer which is supplied with software for the VIC-20 and is supposed to run with other brands of computers with appropriate software. With cable and software, this unit sells for $299.95.

On the self-contained front, DGM Electronics presents its SRT-3000, a RTTY/CW/ASCII terminal. This keyboard-shaped unit features a full TTY line display of 72 characters, buffers, cassette interfacing, and stunt-box features. Its price is listed as $995, with an introductory offer of $795. I don't know how long the "introduction" is going on.

When it comes to AMTOR, AEA takes out an ad of its own to show its new AMT-1 AMTOR terminal. This sleek box will act as a demodulator and modulator for AMTOR RTTY, requiring only a terminal and transceiver. You can use a dumb "glass-TTY" type terminal, computer with terminal software, or even an ASR-33, I guess. At $499.95, this will make quite an impression in the growing AMTOR market.

Speaking of dumb terminals, RCA continues to offer used ASR-33 teleprinters for $300. These are pulled from service, and I have no idea what kind of shape any of them are in, but the price is comparable with most other reputable sources for these printers. This may make the ideal remote terminal for some systems or a low-cost printer for others.

Another TRS-80 interface is advertised by the Royal company. For $199 ($179 in cassette version), this disk program and interface will use an external demodulator to put a TRS-80 Model III or 4 on RTTY/CW/ASCII. Space is provided for stored buffers, split screen, diddle, and other features.

Finally, we come to Microfish, a creative name, which sells a cassette program for the VIC-20 to transmit RTTY in Murray and ASCII for $10.95. I presume an external TU is needed, but the price for the software sure sounds good!

Seven years ago, when I started this column, it was the rare advertiser who mentioned RTTY in an ad, much less took out a full-page spread to promote a product to our market. Times have sure changed! Next month, some more from me and you, here in RTTY Loop.

Companies Mentioned in this Month's Column

Radio Amateur Callbook, Inc.
925 Sherwood Drive, Box 247
Lake Bluff IL 60044

The Ham Shack
808 N. Main Street
Evansville IN 47711

Microlog Corporation
18713 Mooney Drive
Gaithersburg MD 20879

W. H. Nail Company
275 Lodgeview Drive
Oroville CA 95965

Macrotronics, Inc.
1125 N. Golden State Blvd.
Turlock CA 95380

MFJ Enterprises, Inc.
Box 494
Mississippi State MS 39762

Kantronics
1202 E. 23rd Street
Lawrence KS 66044

73 Magazine
PO Box 931
Farmingdale NY 11737

Contemporary Technology, Inc.
PO Box 1083
Salem OR 97308

DGM Electronics, Inc.
787 Briar Lane
Beloit WI 53511

Advanced Electronics Applications (AEA)
PO Box C-2160
Lynnwood WA 98036

J. H. Bell—RCA Service Company
Bldg 204-2, Route 38
Cherry Hill NJ 08358

Royal
407 Conkle Road
Hampton GA 30228

Microfish Software Products
PO Box 920342
Norcross GA 30092

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MRF450A	12.50	28.00	MRF492	20.00	43.00
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MRF435A	15.00	33.00	SRF2769	15.00	33.00
MRF454	16.50	36.00	CD2545	18.50	40.00
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MRF433	14.50	MRF477	13.00
MRF435	42.00	SD1407	37.00
MRF449	14.50	SD1487	28.00
MRF449A	14.50	S10-12	14.50

VHF & UHF TRANSISTORS

Type	Mount	Rating	MHz	Net/ea.
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MRF240	(a)	40W	145-175	15.00
MRF245	(F)	80W	130-175	27.00
MRF247	(F)	80W	130-175	27.00
MRF492	(F)	70W	27-50	20.00
SD1416	(F)	80W	130-175	29.50
SD1477	(F)	125W	130-175	37.00
SD1441	(F)	150W	130-175	83.50
2N6081	(a)	15W	130-175	7.75
2N6082	(a)	25W	130-175	9.75
2N6083	(a)	30W	130-175	9.75
2N6084	(a)	40W	130-175	12.00
2SC1955	—	1W	130-175	15.00
2SC2289	—	5W	130-175	20.00
MRF641	(F)	15W	430-470	18.00
MRF644	(F)	25W	430-470	21.50
MRF646	(F)	45W	430-470	24.50
MRF648	(F)	60W	430-470	33.50

Technical Assistance and cross-reference information on CD, PT, RF, SRF & SD P/N's; Call our Engineering Dept. (619) 744-0728

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Shipping $3 (Air $5). FL Sales Tax 5%

In addition to the above, FOX-TANGO stocks a wide line of $60 SSB, CW, and AM 8-pole filters for Yaesu, Kenwood, Drake R4C and 7-line, and Heathkit. Also, special filters made to order. Send specs for quote.

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↙102

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FUN!

John Edwards KI2U
PO Box 73
Middle Village NY 11379

HAMMING AROUND THE WORLD

Without doubt, amateur radio is a hobby unlike any other. While most pastimes are conducted in solitude or with a few close friends, ham radio is definitely a group activity. In fact, our hobby is one of few activities that just can't be conducted alone.

Unless sending code practice is your sole operating thrill, chances are you have dozens of ham friends. And if you hold a General-class ticket or higher, many of those friends are likely to reside overseas. Like no other hobby, amateur radio opens the door to worldwide communication and understanding. What a pity we so often waste this opportunity on meaningless signal reports and hollow chatter about the weather. Get rid of QSL cards and pass a law against the swapping of temperatures and I think we would have a much better hobby.

This month, FUN! takes a look at hamming around the world. It's time to discover what life is like at the end of that overseas microphone, key, or keyboard.

ELEMENT 1 TRUE-FALSE

	True	False
1) In Japan, a resident alien may obtain an amateur-radio operator's license but not a station license.	____	____
2) If you work a West German station with a "Z" suffix, you are communicating with a German Extra-class licensee.	____	____
3) In New Zealand, Field Day is held in February.	____	____
4) The callsigns LG5FL and SJ9WL both belong to the same station.	____	____
5) Bringing a radio into Greece, without the proper paperwork, can result in a $2500 fine and up to two years imprisonment.	____	____
6) In Hong Kong, a visitor's license costs $100.	____	____
7) Tim Chen BV2B is the only licensed amateur in the People's Republic of China.	____	____
8) Father Moran 9N1MM is the only active amateur in Tibet.	____	____

ELEMENT 2 SCRAMBLED WORDS

Unscramble the names of these countries:

NEWSED	JIIF
NAAPJ	LAPEN
BUCA	YTILA
NACFRE	AAISTRU
AAAILSTRU	LEBZIE

ELEMENT 3 MATCHING

Match the prefix to the correct country.

Column A	Column B
1) VU	A) Benin
2) YI	B) Argentina
3) 7X	C) Latvia
4) LU	D) Honduras
5) HR	E) Bangladesh
6) GW	F) Algeria
7) OX	G) Uzbek
8) UQ2	H) Sweden
9) SU	I) Iraq
10) GU	J) Wales
11) EP	K) Turkey
12) TY	L) India
13) PY	M) Venezuela
14) S2	N) Mexico
15) UI8	O) Brazil
16) TA	P) Egypt
17) 5N	Q) Iran
18) XE	R) Nigeria
19) YK	S) Greenland
20) YV	T) Syria
	U) Guernsey

ELEMENT 4 MATCHING

Column A	Column B
1) *Break-In*	A) Italy
2) *Radio-Rivista*	B) United Kingdom
3) *Radio Communication*	C) United States
4) *73: Amateur Radio's Technical Journal*	D) Canada
5) *TCA*	E) New Zealand
	F) Spain

ELEMENT 5 MATCHING

Match the DX net to its frequency.

Column A	Column B
1) Forty-Meter DX Net	A) 7.270 MHz
2) Africana Net	B) 21.345 MHz
3) Arabian Christian Net	C) 21.355 MHz
	D) 28.510 MHz
4) Pacific International DX Net	E) 21.280 MHz
5) W7PHO Family Hour (15-meter version)	F) 14.305 MHz
	G) 14.225 MHz
6) W7PHO Family Hour (20-meter version)	H) 14.265 MHz
	I) 14.265 MHz
7) DX to DX Net	J) 14.250 MHz
8) 10-Meter DX Net	K) 7.182 MHz
9) P29JS DX Net	
10) Arabian Nights DX Net	

THE ANSWERS

Element 1:

1—True And he must notify the government before operating any station.

2—False Someone employed by the German Department of Telecommunications.

3—True Well, it's summer down there. I hope.

4—True The station is in a place called Morokulien, located on the border between Sweden and Norway. Morokulien, incidentally, means "fun" in both languages. You read it here first.

5—True Yeah, but those window bars make great radiators.

6—True In Hong Kong dollars, of course. That's $16 U.S.

7—False Only ham in Taiwan. On CW, he's BV2A.

8—False Other side of the mountain—Nepal.

Element 2:

(Reading from left to right): SWEDEN, FIJI, JAPAN, NEPAL, CUBA, ITALY, FRANCE, AUSTRIA, AUSTRALIA, BELIZE.

Element 3:

1 = L, 2 = I, 3 = F, 4 = B, 5 = D, 6 = J, 7 = S, 8 = C, 9 = P, 10 = U, 11 = Q, 12 = A, 13 = O, 14 = E, 15 = G, 16 = K, 17 = R, 18 = N, 19 = T, 20 = M.

Element 4:

1 = E, 2 = A, 3 = B, 4 = C, 5 = D.

Element 5:

1 = K, 2 = C, 3 = F, 4 = H or I, 5 = B, 6 = G, 7 = E, 8 = D, 9 = H or I, 10 = J.

SCORING

Element 1:
Two points for each correct answer.

Element 2:
Two points for each country unscrambled.

Element 3:
Two points for each pair matched.

Element 4:
Two points for each pair matched.

Element 5:
Two points for each pair matched.

Are you a ham of the world?

1–20 points—Never traveled more than 25 miles from your QTH.

21–40 points—Once vacationed in Cedar Rapids, Iowa.

41–60 points—Know your way around a map.

61–80 points—A seasoned traveler.

81–100+ points—Home QTH is any DX-pedition.

DR. DIGITAL

Robert Swirsky AF2M
412 Arbuckle Avenue
Cedarhurst NY 11516

DR. DIGITAL'S MAILBAG

Before we continue last month's discussion of dealing with sound using microcomputers, I am going to reach into the Dr. Digital mailbag and pass along some info I've received. Let me state once more: If you want a reply to your letter, please enclose a stamped, self-addressed envelope!

James J. Brown N2AXR asked about the 10-Ohm variable resistor in the VIC-20-to-ham-rig interface (September, 1983). Sorry about that, Jim—that was a misprint. It should have been a 1000-Ohm variable resistor. Actually, any small resistance variable pot will do; it serves to control the level so you don't drive the rig too hard.

For those of you who have TI-99/4A computers, you too can have cassette-port QSOs (see September, 1983, for details). Jim Ketcham KA4AFI tells me that his TI cassette port works fine through his 2-meter hand-held. Jim has been able to send and receive TI cassette-port data through his local repeater. He just has to time himself so the repeater doesn't try to identify during a data transmission!

It seems that the 1802 microprocessor still has a loyal following. Bob KC2WZ, WA2EGP, and K2ULR have been experimenting with this unique chip. Bob says that he "would like to see different makes of computers talk to each other." He also reports success transferring CoCo programs using the cassette port, although QRN has led to some transmission errors.

Atari computer owners would probably find the Atari Microcomputer Network useful. The net, organized by Jack McKirgan II WD8BNG, has a number of sections. Organization is as follows: National Net—14.325 at 1600Z, Sunday; Midwest Regional Net—7.235 at 1830Z, Sunday; West Coast Regional Net—7.235 at 11 am PST, Sunday; Southwest Regional Net—7.230 at 1800Z, Sunday; Pacific NW Regional Net—7.230 at 1800Z, Sunday; Southeast Regional Net—7.235 at 1800Z, Sunday; East Coast Regional Net—3.965 at 8 pm EST, Wednesday; International Net—21.4 at 2330Z, alternate Thursdays; Dayton, Ohio, Net—open channel on 146.445 simplex; Chicago Net—open channel on 147.570 simplex; Central Kentucky Net—145.45 repeat, 9 pm Wednesdays.

The Atari Microcomputer Network also puts out a very informative newsletter, *Ad Astra*. For more information on the newsletter or the net, write to Atari Microcomputer Network, Jack McKirgan II, 4749 S.R. 207 NE, Washington Court House, Ohio 43160.

Joseph J. Fairclough WB2JKJ is doing something unusual with amateur radio and microcomputers: He's using them to help teach English. Joe has an amateur-radio station and a number of microcomputers set up in his classroom at Junior High School #22 in New York City. The high technology serves to create and maintain interest among the students. Using technical publications such as *73* as textbooks, the students in Joe's English class learn about writing. They compare writing styles, catch errors that the copy editors might have missed, and evaluate various publications. The computer and amateur-radio theme keeps the students interested and eager to learn. Joe's unique approach to teaching English has been very successful—he even received a letter from President Reagan congratulating him on the effectiveness of his curriculum.

SOUND: PART II

Last month, we discussed how to detect and measure sound with a computer. Now it's time to look at the other part of the problem—generating sound with a computer. For the purposes of this discussion, I'll divide computers into three classes: computers with no sound-generation hardware, computers with simple console speakers, and computers with separate sound-generating hardware. An example of the first class would be practically any business micro; the only way these can generate sound is through the terminal's beeper. The second type of computer would be the Apple II, Franklin, IBM PC, etc.; these computers have a speaker that can be controlled with software. Atari and VIC computers fall into the third category. These models incorporate circuitry dedicated to sound production. For example, the POKEY chip in the Atari computer can control up to 4 voices. It has a D/A converter, noise generator, and all sorts of options. The VIC computer works in a similar manner. DTMF

generation can be had with a few lines of simple software!

If you have a computer of the first class, don't despair. All you have to do is add an amplifier to one of the output lines of the parallel ports. (If you don't have a parallel port, then you can despair.) Be sure you put an attenuator between your parallel port and your amplifier—there is ±5 V coming out of the port. After you have this, you can consider your computer to be in the second class and use the software techniques that I will describe.

Apples and their relatives have built-in speakers. The speaker is mapped to a specific memory location. Accessing the location with a READ statement will cause the speaker to change state—the sound cone will move from "in" to "out" or vice versa. Note that on the Apple a WRITE to the speaker's location will cause the speaker to click. This is because a WRITE actually performs a READ before it executes.

Other computers with speakers, and those with an amplifier connected to a port, require an I/O statement to cause the speaker to click. The port's number must be determined (consult your hardware manual) and an assembly-language command, usually an OUT command, must be executed. For example, if you have a Z80-based system and have a speaker hooking you to the LSB (least significant bit) line of parallel port #1, the command OUT 1,A can be used to move the speaker's coil in and out. If there is a 1 in the accumulator, the speaker will move out. A zero brings it back in again.

Now that you have the ability to move a speaker in and out, the next step is generating a tone. To do this correctly, we must use assembly language. BASIC is too slow—only low buzzes can be generated under its control. (Some BASICs have built-in sound commands. These can be used, but they generally don't have too much flexibility.) Compiled languages are faster, but they don't allow direct control of the speaker. One doesn't know how long an instruction takes to execute. With assembly language, however, one can precisely determine timing delays. The program in last month's column demonstrated the cycle counting techniques.

The simplest program to generate sound would be (in a pseudo assembly language):

```
START   LOAD    SPEAKER,1
        CALL    DELAY
        BRANCH  START
```

The DELAY subroutine is time critical. It must produce a delay depending on the value of a register. For increased resolution, a 16-bit register should be used. On a computer with only 8-bit registers, a nested loop of two 8-bit index registers can serve the same function. See Listing 1 for a simple tone routine for the Apple computer.

The frequency of the tone generated can be easily computed as follows:

1) Determine the number of clock cycles that the delay routine takes to execute.

Fig. 1. The square wave.

2) Add to this the number of cycles for the LOAD, CALL, and BRANCH statements.

3) Take the reciprocal of the computer's clock frequency in Hertz.

4) Multiply this by the total number of clock cycles for the tone routine.

5) Take the reciprocal of this product.

6) Multiply by 2 to get the frequency at which the speaker is oscillating.

Very accurate tone production is possible with this technique. Unfortunately, you are limited to a square wave (see Fig. 1).

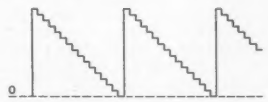

Fig. 2. Sawtooth wave approximated with the Atari POKEY chip.

```
SOURCE FILE: TONE
----- NEXT OBJECT FILE NAME IS TONE.OBJ0
0302:                1         ORG  770
C030:                2 SPKR    EQU  $C030
0302:AD 30 C0        3 START   LDA  SPKR      ;READ THE SPEAKER LOCATION
0305:20 0B 03        4         JSR  DELAY     ;PAUSE FOR A MOMENT
0308:4C 02 03        5         JMP  START     ;GO BACK
030B:AE 00 03        6 DELAY   LDX  768
030E:CA              7 LOOP    DEX
030F:F0 06           8         BEQ  GOBK
0311:0A              9         ASL  A         ;KILL SOME TIME
0312:0A             10         ASL  A
0313:0A             11         ASL  A
0314:4C 0E 03       12         JMP  LOOP
0317:60             13 GOBK    RTS
0318:               14 * I'LL LEAVE FREQUENCY DETERMINATION AS AN EXCERCISE
0318:               15 * FOR THE READER.
0318:               16 *
0318:               17 * THE VALUE IN LOCATION 770 CONTROLS
0318:               18 * THE PITCH OF THE TONE.
0318:               19 *
0318:               20 * PRESS RESET TO STOP THE TONE
0318:               21 *
0318:               22 * THE ROUTINE CAN BE STARTED FROM BASIC
0318:               23 * WITH A CALL 770 COMMAND.

*** SUCCESSFUL ASSEMBLY: NO ERRORS


030B DELAY          0317 GOBK           030E LOOP           C030 SPKR
0302 START

0302 START          030B DELAY          030E LOOP           0317 GOBK
C030 SPKR
```

Listing 1. Simple tone routine for the Apple.

The tone color of a square wave resembles that of a clarinet. It is not possible to generate complex waveforms, although it is possible to approximate them. As a matter of fact, dual tones and speech can be approximated using a square wave. In a later column, I'll discuss computer-generated speech and elaborate on computer-speech techniques.

Computers with sound hardware offer a great deal more flexibility. The Atari, for example, uses a custom chip. It is possible to have 4 tones with 8-bit resolution and to combine sound generators for higher resolution. Also, 16 amplitude levels are available, making it possible to generate a variety of waveforms (see Fig. 2). The waveforms aren't as pure as an analog wave, but they are reasonable approximations. Producing tones on the Atari is simply a matter of POKEing the correct values into the sound registers. Many things can be done directly from BASIC. Also, as the sound hardware is independent of the microprocessor, the sound can be playing as the program is running. It would be easy to use an Atari for any amateur-radio tone-generation task. SSTV, PL tones, and RTTY tones are three obvious examples.

Anyone experimenting with sound on the Atari computer should get a copy of the Atari *Technical Reference Notes*. This extensive manual gives the complete hardware description of the machine. It is a shame that Atari does not supply this information with the computers—you must buy it separately. I'm sure there are many Atari users out there who don't realize the sophistication of the Atari hardware. The documentation Atari supplies with their computers is useless.

Commodore's VIC and 64K computers have hardware similar to the Atari's. Sound generation is also done in hardware and many Atari programming techniques can be transferred to the Commodore line. VIC owners should have no trouble generating RTTY tones, slow-scan tones, or touch-tones with simple programs.

Next month, I'll have a listing of a DTMF generation program for the Atari. Also, I'll start to discuss computerized speech. I appreciate all the mail I have been receiving and will answer all letters if there is an SASE enclosed.

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

CALENDAR

Dec 2–4	**ARRL 160-Meter Contest**
Dec 10–11	**ARRL 10-Meter Contest**
Jan 7	**73 40-Meter World SSB Championship**
Jan 8	**73 75-Meter World SSB Championship**
Jan 14–15	**73 160-Meter World SSB Championship**
Jan 14–15	**Hunting Lions in the Air Contest**
Feb 4–5	**South Carolina QSO Party**
Feb 11–12	**Dutch PACC Contest**
Feb 18–19	**America Radio Club International DX Contest**
Feb 18–19	**YL-ISSB Commo System QSO Party—Phone**
Feb 25	**RTTY World Championship Contest**
Mar 17–18	**YL-ISSB Commo System QSO Party—CW**
Mar 17–18	**Bermuda Contest**

ARRL 160-METER CONTEST
Starts: 2200 GMT December 2
Ends: 1600 GMT December 4

The object is for amateurs worldwide to exchange QSO information with W/VE amateurs on 1.8-MHz CW only. DX-to-DX QSOs are not permitted for contest credit. Operating categories include single operator and multi-operator (single transmitter only). Remember that W/VE stations may transmit only in the segments 1800–1825 and 1830–1850 kHz in conformance with the ARRL band plan. Please refrain from using the 1825–1830-kHz DX window.

EXCHANGE:

RST and ARRL section, DXCC country name, or ITU region (if maritime or aeronautical mobile).

SCORING:

Count 2 points per QSO with amateurs in an ARRL section. W/VE stations count 5 points for DX QSOs. Multiply QSO points by the total number of ARRL sections (74 max) and DXCC countries (W/VE stations only).

ENTRIES:

Official forms and logs are recommended and are available from ARRL headquarters for an SASE or 1 IRC. Logs must indicate time in GMT, call, and exchange. Multipliers should be clearly marked in the log the first time worked. Entries with more than 200 QSOs must include cross-check sheets. Entries must be postmarked by January 4 and addressed to ARRL, Newington CT 06111.

Certificates will be awarded to the top-scoring single operator in each ARRL section and DXCC country and to the top-scoring multi-operator stations in each ARRL division and continent. Usual ARRL conditions of entry and disqualifications apply.

ARRL 10-METER CONTEST
Starts: 0000 GMT December 10
Ends: 2400 GMT December 11

Contact as many stations as possible on the 28-MHz band using no more than 36 hours of the 48-hour contest period. Listening time counts as operating time! Entry categories include: single-operator mixed-mode (phone and CW), phone only, or CW only. Multi-operator class is for single transmitter, mixed-mode only.

No crossmode contacts are allowed. Mixed-mode single-operator and all multi-operator stations may work stations once on CW and once on SSB. One operator may not use more than one callsign from

any given location during the contest period. All entrants may transmit only one signal on the air at any given time.

EXCHANGE:

W/VE stations (including KH6/KL7) send RS(T) and state or province. DX stations send RS(T) and serial number starting with 001. Maritime and aeronautical mobile stations send RS(T) and ITU region (1, 2, 3). Novice and Technician stations sign /N or /T as appropriate.

SCORING:

Count 2 points per phone QSO, 4 points per CW QSO, and 8 points for QSOs with US Novice or Technician stations. Multiply the QSO points by the total number of US states, Canadian call areas, DXCC countries (except US and Canada), and ITU regions (maritime and aeronautical mobiles only).

ENTRIES:

Official logs and entry forms are recommended and are available from ARRL headquarters for an SASE or 2 IRCs. Logs must indicate time in GMT, mode, call, and exchange for each QSO. Multipliers should be clearly marked in the log the first time worked. Entries with more than 500 QSOs must include cross-check sheets. Entries must be postmarked by January 11 and addressed to ARRL, Newington CT 06111.

Certificates will be awarded to: the highest-scoring single-operator station in each category from each ARRL section and DXCC country; top multi-operator entries in each ARRL division and each continent; and additional entries as participation warrants. Usual ARRL entry conditions and disqualifications apply.

3RD ANNUAL 40-METER WORLD SSB CHAMPIONSHIP 0000Z to 2400Z January 7, 1984

SPONSORED BY:

73: Amateur Radio's Technical Journal.

MISCELLANEOUS RULES:

Work as many stations as possible on 40-meter phone during the specified times of allowable operation. The same station may be worked *once*. Crossmode contacts will not count. Single-operator stations may operate a total of 16 hours. All multi-operator stations may operate the entire 24-hour period. Off periods must be noted in your log(s) and on your summary sheet. Off periods are *no less than 30 minutes each.*

OPERATOR CLASSES:

(A) Single operator, single transmitter, phone only. (B) Multi-operator, single transmitter, phone only.

EXCHANGE:

Stations within the continental 48 United States and Canada transmit an RS report and state, province, or territory. All other stations, including Alaska and Hawaii, transmit RS report and DX country.

POINTS:

5 QSO points for contacts with W/VE stations located within the continental 48 United States and Canada. All other contacts score 10 points each. List points for each contact on your log sheet(s).

MULTIPLIERS:

1 multiplier point is earned for each US state, 48 maximum (a District of Columbia contact may be substituted for a Maryland multiplier), each Canadian province or territory (13 maximum), and DX country (excluding the continental US and Canada).

FINAL SCORE:

Total QSO points times total multiplier points equals *claimed score.*

CONTEST ENTRIES:

Each entry must include a contest log, a dupe sheet, a contest summary, and multiplier checklist. We recommend that contestants send for a copy of the contest forms. Send an SASE to the contest address listed below.

CONTEST DEADLINE:

Each entry must be postmarked no later than February 12, 1984.

DISQUALIFICATIONS:

Omission of any required entry form, operating in excess of legal power, manipulating of contest scores or times to achieve a score advantage, or failure to omit duplicate contacts which would reduce the overall score more than 2% are all grounds for immediate disqualification. Decisions of the contest committee are final.

AWARDS:

Contest awards will be issued in each operator class in each of the continental 48 United States, Canadian provinces and territories, and each DX country represented. A minimum of 100 QSOs must be worked to be eligible for contest awards.

CONTEST ADDRESS:

To obtain entry forms or to submit an entry, contact: 40-Meter Contest, Dennis Younker NE6I, 43261 Sixth Street East, Lancaster CA 93535.

BROWARD AMATEUR RADIO BULLETIN

NEWSLETTER OF THE MONTH

"Our immediate goal is to establish a viable, active, and properly trained Amateur Radio Emergency Service (ARES) for Broward County."

Those are the no-nonsense words of Peter Van WE4Q, editor of this month's winning newsletter, the *Broward Amateur Radio Bulletin.* And from the looks of it, Peter has the firepower to back him up—not the least of which is the club newsletter. Active public service is the focus for Broward County's amateurs. it takes the form of civil-defense preparedness, emergency communications, and the more mundane (but equally important) CW and theory classes.

The *Radio Bulletin* provides ample evidence of the Broward County hams' organizational abilities. For starters, the *Bulletin*'s front cover has a table of contents, and each area of interest has its own section. Other sources of information, such as the W5YI report, are cited in the news section.

Finally, the *Bulletin* is good-looking. It is printed in a pleasing combination of light-gold-colored paper and brown ink, giving it a handsome and somewhat formal appearance.

To enter your newsletter in 73's Newsletter of the Month Contest, send it to *73*, Pine Street, Peterborough NH 03458, Attn: Newsletter of the Month.

RESULTS

1983 NEW JERSEY QSO PARTY

Top New Jersey Stations

KC2ME	36,416
KX2W	34,068
W2XQ	22,440
WA2WJY (multi-op)	16,728
WA2UDT	14,850
KA2OIW	13,545

Top Out-of-State Stations

N3DAY	3507
WA2WDT/3	1890
KA1ZX	1848
N1PL/1	1743
WB2IPX	1280
KA8IIN	1188
KK3V	1180
WA3UNX	1160

RESULTS

BERMUDA AMATEUR RADIO CONTEST 1983

UK	
G3UKS	256,500
Canada	
VE3JSZ	21,730
Bermuda	
VP9IX	1,001,160
VP9TAD*	294,480
W. Germany	
DL7OK	116,520
USA	
W1RR	157,750
W4HIR	27,690
K4FU	24,300
KA1CNI	16,300
KE1E	13,625
W1DO	12,960
WB2FSL	10,890
K3DH	10,850
K8PYD	10,260
N2BNC	9,200

*CW winner

3RD ANNUAL 75-METER WORLD SSB CHAMPIONSHIP 0000Z to 2400Z January 8, 1984

SPONSORED BY:

73: Amateur Radio's Technical Journal.

MISCELLANEOUS RULES:

Work as many stations as possible on 75-meter phone during the specified times of allowable operation. The same station may be worked *once*. Crossmode contacts will not count. Single-operator stations may operate a total of 16 hours. All multi-operator stations may operate the entire 24-hour period. Off periods must be noted in your log(s) and on your summary sheet. Off periods are *no less than 30 minutes each.*

OPERATOR CLASSES:

(A) Single operator, single transmitter, phone only. (B) Multi-operator, single transmitter, phone only.

EXCHANGE:

Stations within the continental 48 United States and Canada transmit an RS report and state, province, or territory. All other stations, including Alaska and Hawaii, transmit RS report and DX country.

POINTS:

5 QSO points for contacts with W/VE stations located within the continental 48 United States and Canada. All other contacts score 10 points each. List points for each contact on your log sheet(s).

MULTIPLIERS:

1 multiplier point is earned for each US state, 48 maximum (a District of Columbia contact may be substituted for a Maryland multiplier), each Canadian province or territory (13 maximum), and DX country (excluding the continental US and Canada).

FINAL SCORE:

Total QSO points times total multiplier points equals *claimed score.*

CONTEST ENTRIES:

Each entry must include a contest log, a dupe sheet, a contest summary, and multiplier checklist. We recommend that contestants send for a copy of the contest forms. Send an SASE to the contest address listed below.

CONTEST DEADLINE:

Each entry must be postmarked no later than February 12, 1984.

DISQUALIFICATIONS:

Omission of any required entry form, operating in excess of legal power, manipulating of contest scores or times to achieve a score advantage, or failure to omit duplicate contacts which would reduce the overall score more than 2% are all grounds for immediate disqualification. Decisions of the contest committee are final.

AWARDS:

Contest awards will be issued in each operator class in each of the continental 48 United States, Canadian provinces and territories, and each DX country represented. A minimum of 100 QSOs must be worked to be eligible for contest awards.

CONTEST ADDRESS:

To obtain entry forms or to submit an entry, contact: 75-Meter Contest, Jose A. Castillo N4BAA, 1832 Highland Drive, Amelia Island FL 32034.

5TH ANNUAL 160-METER WORLD SSB CHAMPIONSHIP
0000Z January 14, 1984 to 2400Z January 15, 1984

SPONSORED BY:

73: Amateur Radio's Technical Journal.

OBJECT:

To work as many stations as possible on 160-meter phone in a maximum of 32 hours allowable contest time. Multi-operator stations may operate the entire 48-hour contest period. Stations may be worked only once.

ENTRY CATEGORIES:

(A) Single operator, single transmitter, phone only. (B) Multi-operator, single transmitter, phone only.

EXCHANGE:

Stations within the continental US and Canada transmit RS report and state or province/territory. All others transmit RS report and DX country.

POINTS:

5 QSO points for contact with W/VE stations contacted within the continental 48 United States and Canada. All other contacts earn 10 points each.

MULTIPLIERS:

1 multiplier point will be earned for each of the continental United States, 48 maximum (a District of Columbia contact may be substituted for a Maryland multiplier), each of the Canadian provinces/territories (13 maximum), and each DX country outside the continental 48 United States and Canada.

FINAL SCORE:

Total QSO points times total multiplier points equals *claimed score.*

CONTEST ENTRIES:

Each entry must include log sheets, dupe sheet for 100 or more contacts, a contest summary, and a multiplier check sheet.

ENTRY DEADLINE:

All entries must be postmarked no later than February 19, 1984.

DX WINDOW:

Stations are expected to observe the DX window from 1.825–1.830 MHz as mutually agreed by top-band operators. Stations in the US and Canada are asked not to transmit in this 5-kHz segment of the band. During the contest, all W/VE stations are requested to utilize only those frequencies from 1.808–1.825 and 1.830–1.900 MHz.

DISQUALIFICATIONS:

Disqualification may result if a contestant omits any required entry form, operates in excess of legal power authorized for his/her given area, manipulates operating times to achieve a score advantage, or fails to omit duplicate contacts which reduce the overall score more than 2%. Decisions of the contest committee are final.

AWARDS:

Contest awards will be issued in each entry category in each of the continental United States, each Canadian province/territory, and each DX country. A minimum of 100 QSOs must be worked to qualify.

CONTEST ADDRESS:

To obtain information or entry forms (enclose an SASE) or to submit a contest entry, contact: 160-Meter Contest, Harry Arsenault K1PLR, 603 Powell Avenue, Erie PA 16505.

3RD ANNUAL RTTY WORLD CHAMPIONSHIP
0000Z to 2400Z February 25, 1984

SPONSORED BY:

73: Amateur Radio's Technical Journal and *The RTTY Journal.*

OPERATOR CLASSES:

(A) Single operator, single transmitter. (B) Multi-operator, single transmitter.

ENTRY CATEGORIES:

(A) Single band. (B) Allband, 10-80 meters.

EXCHANGE:

Stations within the 48 continental United States and Canada must transmit RST and state or province/territory. All others must transmit RST and consecutive contact number.

MISCELLANEOUS RULES:

The same station may be worked once on each band. Crossmode contacts do not count. Single-operator stations may work 16 hours maximum, while multi-operator stations may operate the entire 24-hour period. Off times are *no less* than 30 minutes each and must be noted in your log(s).

QSO POINTS:

5 QSO points for contacts with W/VE stations located within the continental United States and Canada. 10 QSO points for all other contacts.

MULTIPLIER POINTS:

1 multiplier point is awarded for each of the 48 continental United States (a District of Columbia contact may be substituted for a Maryland multiplier), Canadian provinces/territories, and DX countries worked on each band (excluding US and Canada).

FINAL POINTS:

Total QSO points times total multipliers equals *claimed score.*

CONTEST ENTRIES:

Entries must include a *separate* log for each band, a dupe sheet, a summary sheet, a multiplier checklist, and a list of equipment used. Contestants are asked to send an SASE to the contest address for official forms.

ENTRY DEADLINE:

All entries must be postmarked no later than April 15, 1984.

DISQUALIFICATIONS:

Omission of the required entry forms, operating in excess of legal power, manipulating scores or times to achieve a score advantage, or failure to omit duplicate contacts which would reduce the overall score more than 2% are all grounds for immediate disqualification. Decisions of the contest committee are final.

AWARDS:

Contest awards will be issued in each entry category and operator class in each of the US call districts and Canadian provinces/territories, as well as in each DX country represented. Other awards may be issued at the discretion of the awards committee. A minimum of 25 QSOs must be worked to be eligible for awards.

CONTEST ADDRESS:

RTTY World Championship, c/o *The RTTY Journal,* PO Box RY, Cardiff CA 92007.

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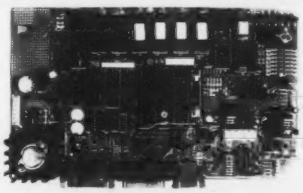

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NEVER SAY DIE
editorial by Wayne Green

from page 6

scriptions (surface mail) is $25 each.

Yes, I'm taking a beating at that rate, but I look at the bright side of it. With the apathy in amateur radio today, how many bucks can I lose? Maybe a dozen of you will probably have any feeling for how happy such a gift would make a foreign ham—particularly one behind the Iron Curtain where they can't subscribe even if they want to because they have Funny Money. I'm not worried.

GETTING INTO THE HAM BUSINESS

Just imagine if your ham shack was a business instead of a personal expense! Well, if you are one of the handful of people who managed to learn to both read and write in school, this blissful state might be achievable.

I got into the ham "business" some thirty years ago when my enthusiasm for amateur radioteletype got so out of hand that I started a monthly newsletter on the subject. This initially philanthropic effort quickly became commercial as the demand for the newsletter grew from the 400 I had envisioned to over 2,000. Philanthropy is fine—in moderation.

Suddenly I was in the newsletter business as a sideline, putting out a monthly publication. That meant I had to have an office in my home to type up the material, draft the diagrams, and take the photographs. It also meant that I could expense my ham purchases, now part of a part-time profitable business.

There are a number of ways to get into the ham business today, with the retailing of ham gear probably one of the very worst. Better to think in terms of writing articles for ham magazines such as this one. It was my RTTY column in *CQ* which leveraged me into the editor's chair there. And that paved the way for me to start *73* five years later.

What to write about? Good heavens! We need articles to encourage amateurs to get involved with new facets of the hobby. RTTY is still, even after all these years, in its infancy. There are dozens—no, hundreds—of needed RTTY articles. OSCAR is extremely underwritten. And the most desperately needed area of all for articles is ham clubs.

Clubs are the strength and the backbone of amateur radio. It's up to our clubs to get youngsters interested in the hobby. It's up to the clubs to have classes to train and license 'em. Clubs should have a wide range of activities to build up ham enthusiasm for the members. Meetings must be fun, even if they include some code practice, a theory discussion, a speaker, and a minimum of club business.

If every club meeting started with a short code-copying test at 10, 20, and 30 wpm, with a prize for the winners in each category, code might turn into being fun. Some members might even do a bit of practicing between meetings in order to get an edge.

DXers should have a chance to infect others with their particularly virulent sickness. Ditto contesters, certificate hunters, and all the other fanatics we breed. Club meetings are the best time to both enjoy and nurture these peculiarities.

There are so many exciting things going on in amateur radio that a writer should be able to turn out one or two articles a month. Some experienced writers look for amateurs who have built a small construction project. Obviously an article should be written, but more often than not, the builder is too busy, so he needs the help of a "professional."

Another area for making money in the hobby is the development of some small product or service which can be sold via mail order. Indeed, many of the larger firms in the ham business got started that way. Electrovoice got started in a garage. Apple, too, started in a garage. My publishing business started in a bedroom in Brooklyn.

Christmas has all sorts of possibilities. It's too late this year, but maybe if you get started planning some special ham Christmas cards or ham jewelry, you'll be ready for 1984.

All is not croissants with running a business in the home. Indeed, you can easily run up against the government bureaucracy with this. It seems that many cities have rather restrictive rules covering businesses in the home. A recent case in Chicago hit the papers when the city declared it illegal for people to use a personal computer in the home for business. And that would include writing articles for pay. If you have such a law in your town, perhaps it's time to get it changed.

Between amateur radio, security systems, and small computers, amateurs couldn't ask for better opportunities to get into small businesses.

POVERTY-STRICKEN HAMS

Now and then I get a letter from a reader whimpering about the price of a subscription or moaning about the high cost of ham gear these days.

As I read *Time* recently, I came across a big article on the bonanza in home protection. Ha! On at least two occasions I have editorialized at length on the opportunities for hams to get into this business. It's a natural for getting started in one's spare time and doesn't take much more than the average ham smarts.

Maybe a dozen hams have grabbed my lapels at hamfests to tell me that they took me seriously on this idea and have, as a result, done very well. Some of them have built up large businesses with dozens of employees—salesmen, installers, and so on.

It's an easy business to get into because there are several firms serving it with mail-order catalogs of the devices and information you need. Of course the business is getting ever more sophisticated, with radio alarms, slow-scan surveillance systems, and so on. That makes it a lot more fun than just putting in some switches, wires, and a big bell.

But the ham who wants to get into some sort of entrepreneurial business can find a wide variety of them where a knowledge of electricity and radio are a help. Some hams have set up television repair benches in their homes and make a very nice piece of change. It's a good cash business. Not a few have gotten into fixing microcomputers, and that could certainly develop into a huge business.

Some keep their eyes open for products which might be of particular interest to hams and be sold via mail-order ads in the ham magazines. Mail order is a clean, fun business. You're your own boss (unless it gets too successful) and it takes almost nothing to get started.

The growth of technology is opening more and more small-business opportunities all the time. But you have to keep your eyes and mind open to spot them. If your eyes are on your TV set, with a six pack and a bag of Doritos at hand, you're going to spend much of your life grumbling about not having enough money.

Computers are complicated, but if you passed your ham license honestly, you're halfway along toward understanding them. There are so many opportunities in the micro field that it is shameful. For instance, maybe you don't know it, but there are, even at this late date, virtually no manufacturer's reps in this field. That's right, there are over 450 manufacturers of microcomputers, all desperate for reps, and absolutely none are available. That's a need for over 6,000 reps right off the top.

What does a rep do? A rep acts as an area salesperson for a manufacturer. He goes to the factory for training on the product and its sales. Then it means getting his butt into every store selling computers in his area—which could be fairly large, if he can handle it.

Does it pay? Well, I have known a lot of reps and most of them used to drive Cadillacs. Now they're more into BMWs and Mercedes. You bet it pays. 10 percent is the norm. Heck, if you only have around twenty stores you cover and each sells only one of your computers a week, figuring the wholesale price around $2,500, that brings you a tidy $21,650 a month. Golly, that would even cover your gas costs, eh? A real hustler can obviously do a lot better than

that if the product is good and the factory support is first rate.

Maybe you aren't looking for the big bucks. Okay, in addition to those 450 micro manufacturers, there are another 2,000 manufacturers of support products—accessories, software, and information. Every one of these is an opportunity. Of course most reps take on a bunch of small non-competing products as well as a major. After all, once you're in the store, the hard part is over. And one good seller will make it a lot easier to write orders for other products.

Another nice home business is gathering information and putting it on a computer as a data base. We are coming to a time when we are going to be able to find just about any information we want via the telephone and a computer. I may want to know how many PBX systems there are when I am contemplating a new product. Okay, I'll be able to dial up a service somewhere which will tell me where to find that data, and then I'll dial up the data. I'll be able to get it in seconds.

Now is the time to start researching and entering this data. How many businesses in America have bought office copiers? How many firms are making modems and who are they? Data is increasing in value, so if you pick out some niche of your own and start your data base, you'll eventually have a marketable product.

It's a frame of mind. Everywhere I look I see opportunities for new and profitable businesses. I'm putting together teams to start at least a dozen right now and some of them have the potential for growing into whole industries. Other people can't find anything to do. If I had another 200 hours a week available, it wouldn't be enough.

Even so, I still get on the air an hour or so a week. That short schedule doesn't give me the time it takes to do an effective job of DX-hunting, but then what a silly way to waste a lifetime! I get my share of DX, but mostly I just sit and chat, often finding some extremely interesting people to talk with. Like the chap who designs fountains. Now it really never occurred to me that there were people who spent their professional lives designing fountains. There are, and one's a ham.

Of course you have to ask about a little more than what rig your contact is using—with all due respect to the manufacturers, who the hell cares? Or wonder about the weather, which most of us have all the time. What's he do? What's he interested in? There's where things could get interesting.

Getting back to making money, it's only your not taking the trouble to think about it and do something which is in the way. It's out there—lots of it. And on almost any pretext, people will thrust it at you.

The people who really have it made when it comes to making extra income are the retired! They have time and a half on their hands and a lifetime of experience available. There are probably dozens of firms around which would be interested in getting work done at home on a contract basis.

The retiree who was in advertising can get any quantity of work he can handle. If the person has learned to write, there are needs for writing about nearby interesting people, activities, and so on. Radio stations need part-time writers. Newspapers ditto. Companies need spec sheets, promotions, and so on. It's endless. Few of us manage to get through a lifetime of work without developing some marketable skills. So market them.

Now and then I hear someone complaining that there are no openings in his area. Balderdash! If you have a skill that a firm needs, you make the opening, you don't wait for it. Oh, this takes a bit of research to find some of the weaknesses of the desired firm that you might be able to help with. But if you come to them and point out the reasons why they can't afford not to hire you, no opening is needed.

There are certain skills which are of lifelong value. Salesmanship is one, and it's not that difficult to learn. My firm needs maybe 50 more salespersons. We've been scouring the woods of New Hampshire for months looking for non-smoking salespeople. Bookkeeping is another road to the gold.

No painter, electrician, plumber, carpenter, or so on will ever be short of work in this part of the country. The paint peels off the houses as fast as you put it on. The pipes freeze every winter. The wiring gets gnawed by mice. And zillions of shelves, new porches, repairs to clapboard, and so forth are needed. The retiree with skills can get work any time.

So let's stop with this nonsense about ham gear being expensive. Baloney, it's a fantastic bargain compared to fifty years ago—even twenty years ago. And magazine subscriptions are a steal. Lookie here, your damned five-cent ice cream cones of a few years ago are a buck now. Your lousy 37-cent cover price magazine should, by the same token, be around $7.40 instead of a crummy $2.495. Stop whining.

Subscriptions that were $3 back then should be around $60 now and they're a miserly $19.97, so what's the beef? And you get a whole lot more magazine for your money to boot.

A LOOK AT PIRATES

Bootleggers, as we used to call them in the early days of amateur radio—pirates today, or "Slim" as some DXers log 'em in—have been with us since the very beginning. In fact, those of you who have been reading *73* for a while will remember that the first transatlantic ham contact was made by a pirate! That's right, we've never found out who made that first big one!

Now that it's so incredibly simple to get a Novice license, we don't have the number of beginner ham pirates we used to. The first ticket used to be about equivalent to our Advanced-class license, a fact which encouraged newcomers to get their code practice on the air. Remember too that about 90 percent of all ham contacts in those days were on CW.

That heavy percentage of CW contacts may help to explain to some newcomers (those of you licensed after WWII) why so many old-time hams are so bound up with the importance of The Code. It really was, at one time, important, and old ideas die hard.

My own stratagem, back in 1938, was to pick a call which likely had been issued but which had not yet come out in the *Callbook*. Yep, the *Callbook* was around then, too. There was all the fun of making contacts and talking with people, with the only serious loss being the QSL card. I hung out on 40m, along with about 75 percent of all hamdom. That was the big band in those days. Of course, that was before foreign broadcasting moved in. And it was before the phone ops rose up against the ARRL, formed the National Amateur Radio Council, and got the FCC to okay a 40m ham phone band over the battered body of the ARRL, which really took a beating at the time.

Nope, 40m was a CW band, pure and simple. Everyone, and I mean everyone, was crystal-controlled, since this was before the invention of the vfo. It was different from today and it was certainly fun. But we can't bring back the old days, we can just remember them.

During the heat of the CB craze when more and more of them were buying sideband rigs and slipping up above the legal channels, there was hysteria in the ham ranks that these turkeys would move into 10m and take over. I tried to reason with these Chicken Littles, but the League was sending their HQ professionals to hamfests preaching panic. The feared invasion never came off, of course.

The CB magazines could have raised hell with us if they had let their readers know the real situation. The fact is that amateur radio has virtually no defense against pirates these days.

In ye olden days, there was the terror of the Radio Inspector. That was followed after 1932 and the formation of the FCC by the fear that an FCC van would pull up in front of your home and an inspector would demand entrance, arrest you, and confiscate your equipment. This did, on rare occasions, happen, so it wasn't a totally unfounded fear.

The situation today is completely different. Sure, we still have laws requiring licenses to operate, but we have an FCC which has been slowly emasculated by laws protecting the guilty and a decreasing amount of money with which to work.

The ham bands are the best policed of any radio service as a result of our own self-policing. Thus the few FCC monitoring stations left seldom bother to even tune a ham band, much less sit there taking bearings on potential pirates and trying to track 'em down. Sending pink slips to erring hams doesn't make money, so it doesn't happen much.

A pirate really has to cause a lot of trouble before the FCC can get any action. Of course if the person has gotten a CB license,

then he's meat for the FCC grinder if he ventures onto the ham bands and actually gets caught red-handed.

About the only thing we have going for us to keep the pirates off our bands is their ignorance. Anyone with a good knowledge of amateur operating could make contacts for years, working DX, working through repeaters, and so on. Who's to know except a QSL bureau somewhere?

Of course getting certificates might present some problems, but then there are obviously going to have to be some sacrifices made by people wanting to avoid even the Bash instant memory system of getting a ham license.

Successful pirates have to change calls periodically, be evasive when talking about personal matters, and not be too blatant about their antennas. Local hams might eventually get curious if a 100-foot tower with a four-element 20m full-sized beam is swinging around their neighborhood.

Other than by a gross unfamiliarity with operating, there is virtually no way to spot 2m mobile pirates. There are so many operators there without even a vague understanding of theory, so a profound ignorance of electronics would never be discovered.

Then we get to the never-never land of marine operating. Once away from land and out of the fiendish clutches of the FCC, who is going to say boo about using the ham bands? This is why such a high percentage of the marine ham stations are pirates. The ITU, from whence all this stems, has no real laws, no police, no monitoring, and very little influence.

Then there are hundreds of religious groups in smaller countries who use the ham bands to keep in touch with each other. Many have even been issued ham calls. These are legal pirates, sort of.

I haven't even hinted at the fun that many licensed hams have by using bogus DX calls. I watched a K2 one time sign a very badly needed DX call in order to see if his rig was working out. It was and the pileup lasted for two hours just from his one CQ while he sat back and guffawed.

There are some hams who point out that if it weren't for an occasional lark like this, the DX chasers would go stir crazy. They need an occasional panic like that to keep fit. And remember the old DX-chaser adage —take no chances; if it sounds like a pirate, work it as fast as you can, just in case it isn't. Work 'em first and ask questions later.

Which brings to mind the antics of several of our more revered DXpeditioners. Like the chap who sat in a hotel in Casablanca and signed the calls of several very rare nearby African countries, making everyone happy. His cards counted for those countries, naturally. Once he paved the way, another DXer did the same thing from Mauritania, and I have his cards from a half dozen countries to prove it.

Those adventures brought on Mr. Big of DXpeditions. I don't know that he was ever at any time in the country he claimed, and I do know of one operation where he was 12,000 miles from where he said. And, yes, most of his QSL cards count for ARRL awards. Now that's pirating on a grand scale. This chap bragged that he was making over $50,000 tax free a year just from DXer donations and I have no reason to disbelieve him.

The drug business in Colombia and other South American countries has leaned heavily on amateur radio. The equipment is cheap. It's available with no questions asked in any quantities. The ham bands are, for the most part, fairly quiet outside of the US and Japan. And 2m—my, oh, my, a wasteland in many areas of the world. So these chaps buy HTs in large numbers, repeaters, the works.

Of course, I can understand the dealer's problem. How can he tell that it isn't a ham buying the equipment? The fact that the chap knows nothing about what he is buying is certainly no clue, right? But when he pulls out a six-inch roll of hundred dollar bills to buy 25 HTs and a repeater, one might expect some hint of question to arise. It should get even more curious when the chap doesn't demand a 20 percent discount but is satisfied to pay the retail price. There was a ham who did that once, but he died.

Are we okay on pirates now?

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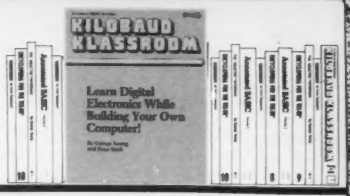

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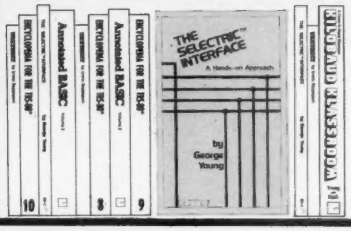

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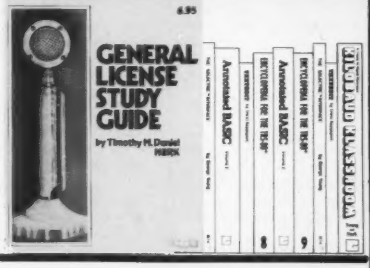

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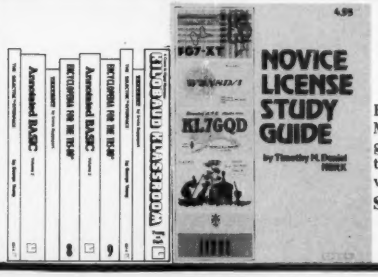

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- ☐5. Over 60

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F. In the last 12 months how much have you spent on purchases from ads in *73*?
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- ☐2. Less than $100
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G. Why do you need the information circled on this card?
- ☐1. Immediate purchase
- ☐2. Purchase in 1-2 months
- ☐3. Brand comparisons
- ☐4. Reference collection

H. When you purchase ham radio or other electronic equipment, which of the following is most important to you in choosing a vendor? Check one only.
- ☐1. Technical expertise
- ☐2. Knowledge of industry trends
- ☐3. Service capability
- ☐4. Prices
- ☐5. Location
- ☐6. Other_____

I. Do you plan to purchase a microcomputer during the next year?
- ☐1. Yes
- ☐2. No

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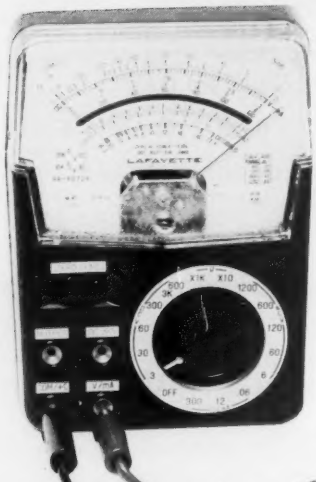

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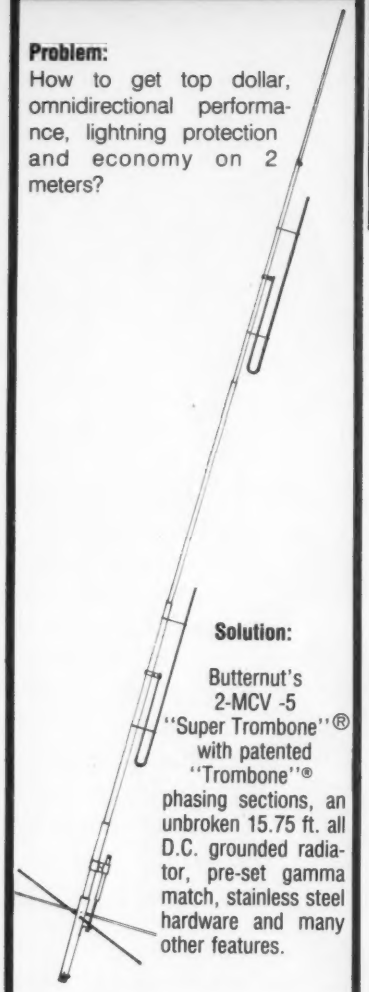

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80-40-20-15-10-6 meter - 2 trap --- 104 ft. with 90 ft. RG58U - connector - Model 998BUC . . . $99.95
40-20-15-10 meter --- 2 trap --- 54 ft. with 90 ft. RG58U - connector - Model 1001BUC $98.95
20-15-10 meter --- 2 trap --- 26ft. with 90 ft. RG58U - connector - Model 1007BUC $97.95

SEND FULL PRICE FOR POSTPAID INSURED. DEL. IN USA. (Canada is $5.00 extra for postage - clerical - customs etc) or order using VISA - MASTER CARD - AMER. EXPRESS. Give number and ex. date. Ph 1-308-236-5333 9AM - 6PM week days. We ship in 2-3 days. ALL PRICES MAY INCREASE . . SAVE - ORDER NOW! All antennas guaranteed for 1 year. 10 day money back trial if returned in new condition! Made in USA. FREE INFO. AVAILABLE ONLY FROM

WESTERN ELECTRONICS Dept. A7-12 Kearney, Nebraska, 68847 ✓80

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- Complete automatic operation
- Erases + Charges + Checks
- Rapid charges in 35 min. (typically)
- Automatically repairs shorted cells
- No dangerous heat build up
- Front panel selects up to 3 different packs
- Unlimited battery combinations with program modules (user programable)
- LED status indicators
- Supplied with universal EZ hook wire leads

Specify Voltage of Battery Pack(s) with order.
One program module included — optional modules $2.25 each.

$89.00 plus $4.00 Shipping
(PA Residents add 6% sales tax)

Now Available—A commercial version of the GMS 401. Designed to charge up to and including the commercial 15 volt Nicad packs. $139.00 plus same shipping and module cost as the GMS 401.

The GMS 401 is a complete automatic NICAD conditioner and rapid charger. Never before has this been offered anywhere at any price and it's so good it's being patented. NICAD memory characteristics must be dealt with otherwise your battery pack is not delivering all it could. The GMS 401 will automatically erase and rapid charge any type NICAD pack from 1 to 10 cells.

CONTROL PRODUCTS UNLIMITED, INC.
P.O. Box 10, Downingtown, PA 19335
215-383-6395 ✓25

BARTER 'N' BUY

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Copy must be received in Peterborough by the 5th of the second month preceding the cover date. If copy is received after the deadline, it will be scheduled to run the following month, unless specifically prohibited by the advertiser.

MATERIALS

Send to Advertising Department, 73, Elm Street, Peterborough NH 03458.

WYOMING-UTAH RANCH LAND. 10 acres, $60 down, $60/month. FREE information, maps, photographs. Trade equity for ham gear, home computer, test equipment, etc. Owner—Mike Gauthier K6ICS, 9550-B—Gallatin Rd., Downey CA 90240. BNB001

EMERGENCY COMMUNICATIONS—An Organizational and Operational Handbook, by K3PUR. A complete reference guide for ARES/RACES and other public service groups. $9.95 plus $1.50 P/H to: FDW Arts, PO Box 2540, Falls Church VA 22042. (VA residents add 4% tax.) BNB003

FREE SAMPLE! Buy/sell/trade radio and computer equipment in "Electronic Exchange." Ads are 20¢/word. 12 issues (1 year), $12.00. Free ad when you subscribe. PO Box 488E, Forest Lake MN 55025. BNB002

WANTED: 10-to-1 geared ratio drive and ZM-30/URM-90. Russ Lawson K1MOU, West Suffield CT 06093; (203)-668-2871. BNB004

TIMEX/SINCLAIR Programs for Dupe Sheet, 5BDXCC, 5BWAS, Logbook, Antenna Design, and Beam Heading. Only $5.95 each. Free information. KENTRONICS, PO Box 586, Vernon AL 35592. BNB005

MOBILE IGNITION SHIELDING. Free literature. Estes Engineering, 930 Marine Drive, Port Angeles WA 98362. BNB006

ATLAS RADIO REPAIR—Specializing in the 180—210x—215x. Factory-trained, fast, experienced, reasonable. Payne Communications, PO Box 977, Vista CA 92083. BNB007

PALOMAR ELECTRONICS CORPORATION EQUIPMENT REPAIR—2 techs, factory-trained, FCC-licensed, experienced, professional. Also available—Palomar equipment service manual—covers over 30 models. Communications Service, PO Box 3262, Escondido CA 92025. BNB008

QSL MANAGER ALBUM™. Beautiful leather-grained vinyl ring binder for displaying 240 of your prized QSL cards. 30-day guarantee. $18.95 ppd or send stamp for flyer. Walter Beaton WD8DVX, 3780 Cecilia Ave., Cleveland OH 44109. BNB009

HEATH HW-12 75-meter transceiver, $50. Army EE-8 field telephones, $22 each. Hartland Smith, Box 452, Birmingham MI 48012; (313)-644-5042. BNB010

NOVICES—TECHNICIANS!! New General-class code course. Unique, progressive method helps you master code quickly, easily. $19.00 + $1 shipping. Free info. Simplex, Box 7010, Dept. 73-11, Bismarck ND 58502. Don't wait! BNB011

ZENERS! 1N5862A 16-V, 500-mW, new. 10 for $1.00, 25 for $2.00. Teflon tubing #8 gauge, 10 ft. for $2.00. Joseph D'Airo, 201 N. Richmond Ave., Massapequa NY 11758. BNB013

DEALERS IN SURPLUS test instruments, microwave equipment, and components. WANTED: late test equipment (H.P., TEK, G.R., Narda, etc.), waveguide diagonal coax components. Immediate needs: H.P. K382A, R382A, S382C, 432A; G.R. 874- and 900-series coax items. Request want list. LECTRONICS, 1423 Ferry Avenue, Camden NJ 08104. Telephone (609)-541-4200. BNB015

TS-830S, VFO-230, $850; Azden PCS-4000, SS-32 tone generator, $255; Heath HW-2036A, TT mike, P3, $145; MFJ-949 tuner, $80; MFJ-484 Grandmaster keyer, $80; Heath bench VTVM, $40. All excellent; manuals. Les Kalmus K2SHL, 257 Central Park West, New York NY 10024; (212)-877-2735. BNB014

NOTRAC 10-METER FM TRANSCEIVER on 29.6 MHz, $65.00...Collins 75-S1 for parts, $50...Heathkit grid-dip meter, $45.00...BC-1003 military VLF-DF receiver with compass-calibrated DF loop antenna (requires 200 V dc and filament supply), $65.00. Trades or best offers. SASE for list of more items. Tim Smith N1BTQ, 27 Hammond Street, PO Box 1084, Mattapoisett MA 02739; (617)-758-9442. BNB016

CORDLESS TELEPHONE, 700-ft. range w/features, $66.00...Walkman-style FM stereo w/headphones, $15.00...radar detectors, car and home stereos...SASE for more info and latest discount lists. TIMELEC, PO Box 1084, Mattapoisett MA 02739. BNB017

WANTED: Early telegraph instruments for my collection. Keys, sounders, call boxes, registers, meters, and related items including pre-1910 paper. Larry Nutting WD6DTC, 5957 Yerba Buena, Santa Rosa CA 95405. BNB018

COMPUTER OWNERS! Super new MFJ 1224 CW/RTTY/ASCII terminal units. Send/receive CW/RTTY/VIC-20 and Commodore 64 software. Full-featured, disk or cassette. Kantronics, too. Low prices, speedy delivery. Hundreds sold internationally. SASE for details and catalog of Commodore, Atari, PET, ZX-81, TI, TRS-80 software and accessories. Amateur Accessories, 6 Harvest Court, RD 7, Dept. BB, Flemington NJ 08822. Telephone (201)-782-1551, 6:30-10:30 Eastern time. BNB019

CLEANING SHACK: Motorola, GE FM gear, test equipment, misc. items. SASE for list. Geoff Fors WB6NVH, PO Box 2946, Carmel CA 93921. BNB020

WANTED: Mobile housings for RCA 700 series and GE EXEC; GE MASTR test set; Motorola HT-200 charger. Geoff Fors, PO Box 2946, Carmel CA 93921. BNB021

RTTY FOR THE TI99/4a. Mini memory required. Mark and space tones are internally generated in send mode although an inexpensive converter is needed for receive. $17.95. Mark Schmidt, 4661 Lark Dr., Beale AFB CA 95903. BNB022

SATELLITES

Amateur Satellite Reference Orbits

		OSCAR 8		RS-5		RS-6		RS-7		RS-8		
	Date	UTC	EQX	UTC	EQX	UTC	EQX	UTC	EQX	UTC	EQX	Date
Dec	1	0126	111	0048	190	0126	206	0102	196	0052	190	1
	2	0130	112	0043	190	0111	204	0052	195	0050	191	2
	3	0135	113	0037	191	0055	201	0042	195	0047	191	3
	4	0139	114	0032	191	0040	199	0033	194	0044	192	4
	5	0000	90	0027	191	0024	197	0023	193	0041	193	5
	6	0004	91	0021	191	0009	194	0013	192	0038	194	6
	7	0009	92	0016	191	0152	222	0004	191	0035	195	7
	8	0013	93	0011	192	0137	220	0153	220	0033	195	8
	9	0017	94	0005	192	0122	217	0144	219	0030	196	9
	10	0022	95	0000	192	0106	215	0134	218	0027	197	10
	11	0026	96	0154	222	0051	213	0124	217	0024	198	11
	12	0031	97	0149	222	0035	210	0115	216	0021	199	12
	13	0035	99	0144	223	0020	208	0105	216	0018	200	13
	14	0039	100	0138	223	0005	206	0055	215	0016	200	14
	15	0044	101	0133	223	0148	233	0046	214	0013	201	15
	16	0048	102	0127	223	0132	231	0036	213	0010	202	16
	17	0052	103	0122	223	0117	228	0026	212	0007	203	17
	18	0057	104	0117	224	0102	226	0017	211	0004	204	18
	19	0101	105	0111	224	0046	224	0007	210	0001	204	19
	20	0105	106	0106	224	0031	221	0157	239	0158	235	20
	21	0110	108	0101	224	0015	219	0147	238	0155	236	21
	22	0114	109	0055	224	0000	217	0137	238	0153	237	22
	23	0118	110	0050	224	0143	244	0128	237	0150	238	23
	24	0123	111	0045	225	0128	242	0118	236	0147	239	24
	25	0127	112	0039	225	0112	240	0108	235	0144	239	25
	26	0131	113	0034	225	0057	237	0059	234	0141	240	26
	27	0136	114	0029	225	0042	235	0049	233	0138	241	27
	28	0140	115	0023	225	0026	233	0039	232	0136	242	28
	29	0001	91	0018	226	0011	230	0030	231	0133	243	29
	30	0005	92	0013	226	0154	258	0020	230	0130	244	30
	31	0010	93	0007	226	0139	255	0010	229	0127	244	31
Jan	1	0014	94	0002	226	0123	253	0001	229	0124	245	1
	2	0018	95	0156	256	0108	251	0150	258	0121	246	2
	3	0023	96	0151	257	0052	248	0141	257	0119	247	3
	4	0027	97	0146	257	0037	246	0131	256	0116	248	4
	5	0031	98	0140	257	0022	244	0121	255	0113	248	5
	6	0036	100	0135	257	0006	241	0112	254	0110	249	6
	7	0040	101	0130	257	0150	269	0102	253	0107	250	7
	8	0044	102	0124	258	0134	267	0052	252	0104	251	8
	9	0049	103	0119	258	0119	264	0043	251	0102	252	9
	10	0053	104	0113	258	0103	262	0033	251	0059	252	10
	11	0057	105	0108	258	0048	260	0023	250	0056	253	11

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160, 80, and 40 meters

Outstanding DX performance of slopers is well known. Now you can enjoy 2 or 3 band BIG-SIGNAL reports! Automatic bandswitching • Very low SWR • Coax feed • 2kw power • Compact • Ground or tower feed • Hang from any support 25 ft. high or higher • Easy to install • Very low profile • Complete instructions • Immediate shipment • Check ok

3 BAND SLOPER · 160, 80, & 40 Meters · 60 ft. long	$ 43.95 frt.ppd
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ON YOUR HOME COMPUTER!

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DATE: 15 NOVEMBER
10.7-CM FLUX: 118          SUNSPOT NR: 68
FM: W3NIZ MILLERSVL MD     39-05N 076-37W
TO: COPENHAGEN DENMARK     55-40N 012-30E
DISTANCE: 6476 KM = 4024 MI = 3497 NM
BEARING: 042
   UT     MUF          UT     MUF
 0000    9.1         1200   19.0
 0100    8.9         1300   19.3
 0200    8.8         1400   19.2
 0300    8.7         1500   18.9
 0400    8.6         1600   18.2
 0500    8.5         1700   17.1
 0600    8.5         1800   15.3
 0700    8.4         1900   11.0
 0800    8.6         2000   10.4
 0900    8.5         2100   10.0
 1000   13.5         2200    9.6
 1100   17.1         2300    9.3
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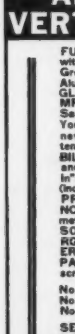

FULL 1/4th WAVE - All Bands! Automatic Selection with proven Hi-Q Traps. 3 Models-ALL self supporting Ground or roof mount. HEAVY Double wall seamless Aluminum lower section - Hi STRENGTH FIBERGLASS TUBING OVER -ALL NO WOBBLY, LUMPY TRAPS - NO UNSIGHTLY CLAMPS needed Same size all the way up 1 1/4" - Traps hidden inside. You can use it in a 1 ft. sq. Backyard Neighbors will never know this is a Hi-Power ALL Direction DX Antenna. FOR APARTMENTS, ROW HOUSES, MOBILE HOMES - CONDOS etc. where minimum space and neat appearance is MANDATORY! Instant "Drive In" ground mount (included). Use with or without radials (included) (All angle roof mount - Extra) COMPLETELY PRETUNED - NO ADJUSTMENTS NEEDED EVER! NO TUNER NEEDED Over All Bands (except 80 meter - 400 KC) SWR 1-1 to 2-1 at Band edges, Std. 50239 connecter - 50 ohm for any length RG58U " RG8U feedline. Matches ALL MAKES TRANSCEIVERS. 2000 Watt PEP input power. Shipped - PREPAID IN USA. Assembles in 10 min. using only screwdriver. WEATHERPROOF!

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No.- AVT20-10 — 3 Band — 11'4" — $99.95

SEND FULL PRICE FOR PP DEL IN USA (Canada is $10.00 extra for postage, clerical, Customs etc.) or order using VISA, MASTER CARD or AMERICAN EXPRESS, Give Number and Ex. date. Ph 1-308-236-5333 9AM-6PM weekdays. We ship in 2-3 days. Prices will increase, so order NOW AND SAVE. All Antennas Guaranteed for 1 year -10 day money back trial, if returned in new condition. Free Inf.

WESTERN ELECTRONICS ↙80
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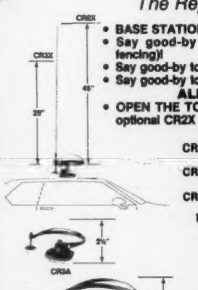
The Repeater Beaters



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ALL THIS PLUS

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CR4A (440 MHz) **$35**
plus $2 shipping

CR2X or CR3X **$12** plus **$2** shipping (continental USA)

*AS REVIEWED IN 73 MAGAZINE OCTOBER 1982

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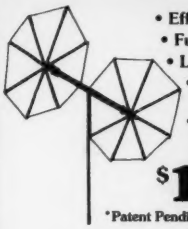

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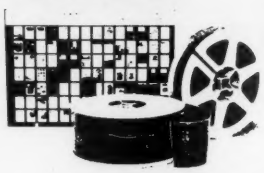

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Provides +5, +12 and -12 volts at 1 amp for your ham radio project. Uses 78xx series positive voltage regulators. Needs 2 transformer windings, 18-24 volts (1 center tapped). 3.50" x 4.50"
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Single-sided fiberglas mother board. An excellent foundation for your STD bus computer. Mounts 12 of our 56 pin connectors. Provide your own card cage and save hundreds of dollars. 3.80" x 7.00"
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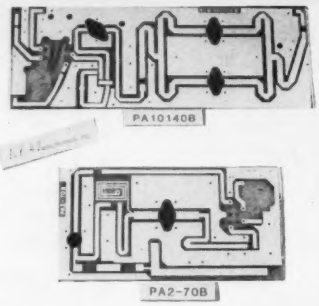

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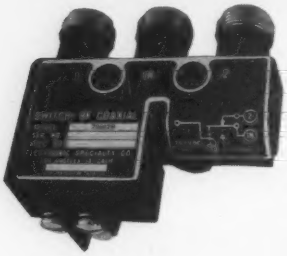

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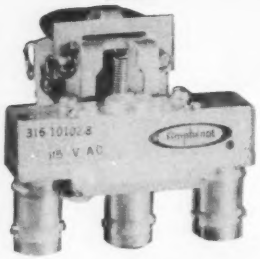
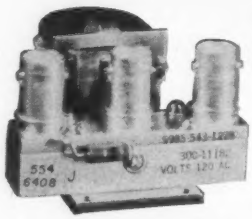
FXR
Part # 300-11182
120Vac Type BNC DC to 4 GHz.
FSN 5985-543-1225

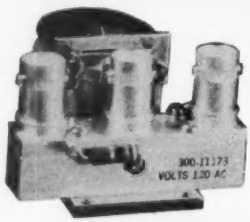
$39.99

FXR
Part # 300-11173
120Vac Type BNC Same
FSN 5985-543-1850

$39.99







BNC To Banana Plug Coax Cable RG-58 36 inch or BNC to N Coax Cable RG-58 36 inch.

$7.99 or 2 For $13.99 or 10 For $50.00 $8.99 or 2 For $15.99 or 10 For $60.00

SOLID STATE RELAYS

P&B Model ECT1DB72 PRICE EACH $5.00	5vdc turn on	120vac contact at 7amps or 20amps on a 10"x 10"x .124 aluminum. Heatsink with silicon grease.
Digisig, Inc. Model ECS-215 PRICE EACH $7.50	5vdc turn on	240vac contact 14amps or 40amps on a 10"x 10"x .124 aluminum. Heatsink with silicon grease.
Grigsby/Barton Model GB7400 PRICE EACH $7.50	5vdc turn on	240vac contact at 15amps or 40amps on a 10"x 10"x .124 aluminum. Heatsink with silicon grease.

NOTE: *** Items may be substituted with other brands or equivalent model numbers. ***

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RECALL PHONE MEMORY TELEPHONE WITH 24 NUMBER AUTO DIALER

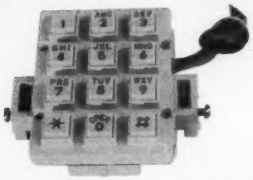
The Recall Phone Telephone employs the latest state of art communications technology.It is a combination telephone and automatic dialer that uses premium-quality,solid-state circuitry to assure high-reliability performance in personal or business applications. $49.99

ARON ALPHA RAPID BONDING GLUE

Super Glue #CE-486 high strength rapid bonding adhesive.Alpha Cyanoacrylate.Set-Time 20 to 40 sec.,0.7fl.oz.(20gm.) $2.00

TOUCH TONE PAD

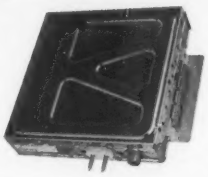
This pad contains all the electronics to produce standard touch-tone tones. New with data.



$9.99 or 10/$89.99

MITSUMI UHF/VHF VARACTOR TUNER MODEL UVE1A

Perfect for those unscrambler projects. New with data.



$19.99 or 10/$149.99

INTEGRATED CIRCUIT.		1 to 10	11up
MC1372P	Color TV Video Modulator Circuit.	$ 4.42	$2.95
MC1358P	IF Amp.,Limiter,FM Detector,Audio Driver,Electronic Attenuator.	5.00	4.00
MC1350P	IF Amplifier	1.50	1.25
MC1330A1P	Low Level Video Detector	1.50	1.15
MC1310P	FM Stereo Demodulator	4.29	3.30
MC1496P	Balanced Modulator/Demodulator	1.50	1.25
LM565N	Phase Locked Loop	2.50	2.00
LM380N14	2Watt Audio Power Amplifier	1.56	1.25
LM1889N	TV Video Modulator	5.00	4.00
NE564N	Phase Locked Loop	10.00	8.00
NE561N	Phase Locked Loop	10.00	8.00

FERRANTI ELECTRONICS AM RADIO RECEIVER MODEL ZN414 INTEGRATED CIRCUIT.

Features:

1.2 to 1.6 volt operating range.,Less than 0.5ma current consumption. 150KHz to 3MHz Frequency range.,Easy to assemble,no alignment necessary. Effective and variable AGC action., Will drive an earphone direct. Excellent audio quality.,Typical power gain of 72dB.,TO-18 package. With data. $2.99 or 10 For $24.99

NI CAD RECHARGEABLE BATTERIES

AA Battery Pack of 6 These are Factory New. $5.00

SUB C Pack of 10 2.5Amp/Hr. $10.00

Gates Rechargeable Battery Packs

12vdc at 2.5Amp/Hr. $11.99
12vdc at 5Amp/Hr. $15.99

MOTOROLA MRF559 RF TRANSISTOR

hfe 30min 90typ 200max.
ft 3000mhz
gain 8db min 9.5typ at 870mhz
13db typ at 512mhz
output power .5watts at 12.5vdc at 870mhz.

$2.05 or 10/$15.00

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"SOCKETS AND CHIMNEYS"

EIMAC TUBE SOCKETS AND CHIMNEYS

		$POR
SK110	Socket	
SK300A	Socket For 4CX5000A,R,J, 4CX10,000D, 4CX15,000A,J	$520.00
SK400	Socket For 4-125A,250A,400A,400C,4PR125A,400A,4-500A,5-500A	260.00
SK406	Chimney For 4-250A,400A,400C,4PR400A	74.00
SK416	Chimney For 3-400Z	36.00
SK500	Socket For 4-1000A/4PR1000A/B	390.00
SK600	Socket For 4CX250B,BC,FG,R,4CX350A,F,FJ	51.00
SK602	Socket For 4CX250B,BC,FG,R,4CX350A,F,FJ	73.00
SK606	Chimney For 4CX250B,BC,FG,R,4CX350A,F,FJ	11.00
SK607	Socket For 4CX600J,JA	60.00
SK610	Socket For 4CX600J,JA	60.00
SK620	Socket For 4CX600J,JA	66.00
SK626	Chimney For 4CX600J,JA	10.00
SK630	Socket For 4CX600J,JA	66.00
SK636B	Chimney For 4CX600J,JA	34.00
SK640	Socket For 4CX600J,JA	36.00
SK646	Chimney For 4CX600J,JA	71.00
SK700	Socket For 4CX300A,Y,4CX125C,F	225.00
SK711A	Socket For 4CX300A,Y,4CX125C,F	225.00
SK740	Socket For 4CX300A,Y,4CX125C,F	86.00
SK770	Socket For 4CX300A,Y,4CX125C,F	86.00
SK800A	Socket For 4CX1000A,4CX1500B	225.00
SK806	Chimney For 4CX1000A,4CX1500B	40.00
SK810	Socket For 4CX1000A,4CX1500B	225.00
SK900	Socket For 4X500A	300.00
SK906	Chimney For 4X500A	57.00
SK1420	Socket For 5CX3000A	650.00
SK1490	Socket For 4CV8000A	585.00

JOHNSON TUBE SOCKETS AND CHIMNEYS

124-111/SK606	Chimney For 4CX250B,BC,FG,R, 4CX350A,F,FJ	$ 10.00
122-0275-001	Socket For 3-500Z, 4-125A, 250A, 400A, 4-500A, 5-500A	(pair)15.00
124-0113-00	Capacitor Ring	15.00
124-116/SK630A	Socket For 4CX250B,BC,FG,R, /4CX350A,F,FJ	55.00
124-115-2/SK620A	Socket For 4CX250B,BC,FG,R, /4CX350A,F,FJ	55.00
	813 Tube Socket	20.00

TUBE CAPS (Plate)

HR1, 4	$11.00
HR2,3, 6 & 7	13.00
HR5, 8	14.00
HR9	17.00
HR10	20.00

CHIP CAPACITORS

.8pf	10pf	100pf*	430pf
1pf	12pf	110pf	470pf
1.1pf	15pf	120pf	510pf
1.4pf	18pf	130pf	560pf
1.5pf	20pf	150pf	620pf
1.8pf	22pf	160pf	680pf
2.2pf	24pf	180pf	820pf
2.7pf	27pf	200pf	1000pf/.001uf*
3.3pf	33pf	220pf*	1800pf/.0018uf
3.6pf	39pf	240pf	2700pf/.0027uf
3.9pf	47pf	270pf	10,000pf/.01uf
4.7pf	51pf	300pf	12,000pf/.012uf
5.6pf	56pf	330pf	15,000pf/.015uf
6.8pf	68pf	360pf	18,000pf/.018uf
8.2pf	82pf	390pf	

PRICES: 1 to 10 - .99¢ 101 to 1000 .60¢ * IS A SPECIAL PRICE: 10 for $7.50
11 to 50 - .90¢ 1001 & UP .35¢ 100 for $65.00
51 to 100 - .80¢ 1000 for $350.00

WATKINS JOHNSON WJ-V907: Voltage Controlled Microwave Oscillator $110.00

Frequency range 3.6 to 4.2GHz, Power ouput, Min. 10dBm typical, 8dBm Guaranteed. Spurious output suppression Harmonic (nf_0), min. 20dB typical, In-Band Non-Harmonic, min. 60dB typical, Residual FM, pk to pk, Max. 5KHz, pushing factor, Max. 8KHz/V, Pulling figure (1.5:1 VSWR), Max. 60MHz, Tuning voltage range +1 to +15volts, Tuning current, Max. -0.1mA, modulation sensitivity range, Max. 120 to 30MHz/V, Input capacitance, Max. 100pf, Oscillator Bias +15 +-0.05 volts @ 55mA, Max.

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(For orders only)

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TUBES

TYPE	PRICE	TYPE	PRICE	TYPE	PRICE
2C39/7289	$ 34.00	1182/4600A	$500.00	ML7815AL	$ 60.00
2E26	7.95	4600A	500.00	7843	107.00
2K28	200.00	4624	310.00	7854	130.00
3-500Z	102.00	4657	84.00	ML7855KAL	125.00
3-1000Z/8164	400.00	4662	100.00	7984	14.95
3B28/866A	9.50	4665	500.00	8072	84.00
3CX400U7/8961	255.00	4687	P.O.R.	8106	5.00
3CX1000A7/8283	526.00	5675	42.00	8117A	225.00
3CX3000F1/8239	567.00	5721	250.00	8121	110.00
3CW30000H7	1700.00	5768	125.00	8122	110.00
3X2500A3	473.00	5819	119.00	8134	470.00
3X3000F1	567.00	5836	232.50	8156	12.00
4-65A/8165	69.00	5837	232.50	8233	60.00
4-125A/4D21	79.00	5861	140.00	8236	35.00
4-250A/5D22	98.00	5867A	185.00	8295/PL172	500.00
4-400A/8438	98.00	5868/AX9902	270.00	8458	35.00
4-400B/7527	110.00	5876/A	42.00	8462	130.00
4-400C/6775	110.00	5881/6L6	8.00	8505A	95.00
4-1000A/8166	444.00	5893	60.00	8533W	136.00
4CX250B/7203	54.00	5894/A	54.00	8560/A	75.00
4CX250FG/8621	75.00	5894B/8737	54.00	8560AS	100.00
4CX250K/8245	125.00	5946	395.00	8608	38.00
4CX250R/7580W	90.00	6083/AZ9909	95.00	8624	100.00
4CX300A/8167	170.00	6146/6146A	8.50	8637	70.00
4CX350A/8321	110.00	6146B/8298	10.50	8643	83.00
4CX350F/8322	115.00	6146W/7212	17.95	8647	168.00
4CX350FJ/8904	140.00	6156	110.00	8683	95.00
4CX600J/8809	835.00	6159	13.85	8877	465.00
4CX1000A/8168	242.50*	6159B	23.50	8908	13.00
4CX1000A/8168	485.00	6161	325.00	8950	13.00
4CX1500B/8660	555.00	6280	42.50	8930	137.00
4CX5000A/8170	1100.00	6291	180.00	6L6 Metal	25.00
4CX10000D/8171	1255.00	6293	24.00	6L6GC	5.03
4CX15000A/8281	1500.00	6326	P.O.R.	6CA7/EL34	5.38
4CW800F	710.00	6360/A	5.75	6CL6	3.50
4D32	240.00	6399	540.00	6DJ8	2.50
4E27A/5-125B	240.00	6550A	10.00	6DQ5	6.58
4PR60A	200.00	6883B/8032A/8552	10.00	6GF5	5.85
4PR60B	345.00	6897	160.00	6GJ5A	6.20
4PR65A/8187	175.00	6907	79.00	6GK6	6.00
4PR1000A/8189	590.00	6922/6DJ8	5.00	6HB5	6.00
4X150A/7034	60.00	6939	22.00	6HF5	8.73
4X150D/7609	95.00	7094	250.00	6JG6A	6.28
4X250B	45.00	7117	38.50	6JM6	6.00
4X250F	45.00	7203	P.O.R.	6JN6	6.00
4X500A	412.00	7211	100.00	6JS6C	7.25
5CX1500A	660.00	7213	300.00*	6KN6	5.05
KT88	27.50	7214	300.00*	6KD6	8.25
416B	45.00	7271	135.00	6LF6	7.00
416C	62.50	7289/2C39	34.00	6LQ6 G.E.	7.00
572B/T160L	49.95	7325	P.O.R.	6LQ6/6MJ6 Sylvania	9.00
592/3-200A3	211.00	7360	13.50	6ME6	8.90
807	8.50	7377	85.00	12AT7	3.50
811A	15.00	7408	2.50	12AX7	3.00
812A	29.00	7609	95.00	12BY7	5.00
813	50.00	7735	36.00	12JB6A	6.50

NOTE * = USED TUBE

NOTE P.O.R. = PRICE ON REQUEST

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"FILTERS"

COLLINS Mechanical Filter #526-9724-010 MODEL F455Z32F

455KHZ at 3.2KHz wide. May be other models but equivalent. May be used or new. $15.99

ATLAS Crystal Filters

5.595-2.7/8/LSB, 5.595-2.7/LSB
8 pole 2.7KHz wide Upper sideband. Impedence 800ohms 15pf In/800ohms 0pf out. 19.99

5.595-2.7/8/U, 5.595-2.7/USB
8 pole 2.7Khz wide Upper sideband. Impedence 800ohms 15pf In/800ohms 0pf out. 19.99

5.595-.500/4, 5.595-.500/4/CW
4 pole 500 cycles wide CW. Impedance 800ohms 15pf In/800ohms 0pf out. 19.99

9.0USB/CW
6 pole 2.7KHz wide at 6dB. Impedance 680ohms 7pf In/300ohms 8pf out. CW-1599Hz 19.99

KOKUSAI ELECTRIC CO. Mechanical Filter #MF-455-ZL/ZU-21H

455KHz at Center Frequency of 453.5KC. Carrier Frequency of 455KHz 2.36KC Bandwidth.
Upper sideband. (ZU) 19.99
Lower sideband. (ZL) 19.99

****

CRYSTAL FILTERS

NIKKO	FX-07800C	7.8MHz	$10.00
TEW	FEC-103-2	10.6935MHz	10.00
SDK	SCH-113A	11.2735MHz	10.00
TAMA	TF-31H250	CF 3179.3KHz	19.99
TYCO/CD	001019880	10.7MHz 2pole 15KHz bandwidth	5.00
MOTOROLA	4884863B01	11.7MHz 2pole 15KHz bandwidth	5.00
PTI	5350C	12MHz 2pole 15KHz bandwidth	5.00
PTI	5426C	21.4MHz 2pole 15KHz bandwidth	5.00
PTI	1479	10.7MHz 8pole bandwidth 7.5KHz at 3dB, 5KHz at 6dB	20.00
COMTECH	A10300	45MHz 2pole 15KHz bandwidth	6.00
FRC	ERXF-15700	20.6MHz 36KHz wide	10.00
FILTECH	2131	CF 7.825MHz	10.00

****

CERAMIC FILTERS

AXEL	4F449	12.6KC Bandpass Filter 3dB bandwidth 1.6KHz from 11.8-13.4KHz	10.00
CLEVITE	TO-01A	455KHz+-2KHz bandwidth 4-7% at 3dB	5.00
	TCF4-12D36A	455KHz+-1KHz bandwidth 6dB min 12KHz, 60dB max 36KHz	10.00
MURATA	BFB455B	455KHz	2.50
	BFB455L	455KHz	3.50
	CFM455E	455KHz +-5.5KHz at 3dB , +-8KHz at 6dB , +-16KHz at 50dB	6.65
	CFM455D	455KHz +-7KHz at 3dB , +-10KHz at 6dB , +-20KHz at 50dB	6.65
	CFR455E	455KHz +-5.5KHz at 3dB , +-8KHz at 6dB , +-16KHz at 60dB	8.00
	CFU455B	455KHz +-2KHz bandwidth +-15KHz at 6dB, +-30KHz at 40dB	2.90
	CFU455C	455KHz +-2KHz bandwidth +-12.5KHz at 6dB , +-24KHz at 40dB	2.90
	CFU455G	455KHz +-1KHz bandwidth +-4.5KHz at 6dB , +-10KHz at 40dB	2.90
	CFU455H	455KHz +-1KHz bandwidth +-3KHz at 6dB , +-9KHz at 40dB	2.90
	CFU455I	455KHz +-1KHz bandwidth +-2KHz at 6dB , +-6KHz at 40dB	2.90
	CFW455D	455KHz +-10KHz at 6dB , +-20KHz at 40dB	2.90
	CFW455H	455KHz +-3KHz at 6dB , +-9KHz at 40dB	2.90
	SFB455D	455KHz	2.50
	SFD455D	455KHz +-2KHz , 3dB bandwidth 4.5KHz +-1KHz	5.00
	SFE10.7MA	10.7MHz 280KHz +-50KHz at 3dB , 650KHz at 20dB	2.50
	SFE10.7MS	10,7MHz 230KHz +-50KHz at 3dB , 570KHz at 20dB	2.50
	SFG10.7MA	10.7MHz	10.00
NIPPON	LF-B4/CFU455I	455KHz +-1KHz	2.90
	LF-B6/CFU455H	455KHz +-1KHz	2.90
	LF-B8	455KHz	2.90
	LF-C18	455KHz	10.00
TOKIN	CF455A/BFU455K	455KHz +-2KHz	5.00
MATSUSHIRA	EFC-L455K	455KHz	7.00

****

SPECTRA PHYSICS INC. Model 088 HeNe LASER TUBES

POWER OUTPUT 1.6MW. BEAM DIA. .75MM BEAM DIR. 2.7MR 8KV STARTING VOLTAGE DC
68K OHM 1WATT BALLAST 1000VDC +-100VDC At 3.7MA $59.99

ROTRON MUFFIN FANS Model MARK4/MU2A1

115 VAC 14WATTS 50/60CPS IMPEDENCE PROTECTED-F 88CFM at 50CPS $ 7.99
105CFM at 60CPS

THESE ARE NEW

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HEWLETT PACKARD SIGNAL GENERATORS

606A	50KHz to 65MHz in 6 bands +-1%,Output level adjustable 0.1uV to 3V into 50 ohms.Built-in crystal calibrator.400 -1000Hz modulation.	$ 650.00
606B	Same as above but has frequency control feature to allow operation with HP 8708A Synchronizer.	$1100.00
608C	10MHz to 480MHz,0-1uV-1V into 50 ohms,AM,CW,or pulse modulation, calibrated attenuator.	$ 500.00
608D/ TS510	10MHz to 420MHz, 0.1uV-0.5V into 50 ohms,+-0.5% accuracy, built-in crystal calibrator, AM-CW or pulse output.	$ 375.00
608E	Improved version of popular 608C.Up to 1V output.Improved stability,low residual FM.	$1450.00
608F	10MHz to 455MHz in 5 bands +-1% frequency accuracy with built-in crystal calibrator.Can be used with HP 8708A Synchronizer. Output continuously adjustable from .1uV to .5V into 50 ohms.	$1100.00
612A	450-1230MHz ,0.1uV-0.5V into 50 ohms,calibrated output.	$ 750.00
614A	900-2100MHz with many features including calibrated output and all modulation characteristics.	$ 500.00
616A/ TS403	Direct reading and direct control from 1.8 to 4.2GHz. The H.P.616A features +-1.5dB calibrated output accuracy from -3127dBm to -dBm.The output is directly calibrated in microvolts and dBm with continuous monitoring. Simple operation frequency dial accuracy is +-1% and stability exceeds 0.005%-/ C change in ambient temperature. Calibrated attenuator is within +-1.5dB over entire output band. 50 ohm impedance unit has internal pulse modulation with rep rate variable from 40 Hz to 4KHz,variable pulsewidth(1 to 10usec)and variable pulse delay(3 to 300usec).External modulating inputs increas versatility.	$ 375.00
616B	Same as above but later model.	$ 600.00
618B	3.8 to 7.6GHz range,with calibrated output and selection of pulse-FM or square wave modulation.	$ 600.00
618C	Same as above but later model.	$2200.00
620A	7 to 11GHz range,with calibrated output and selection of pulse-FM or square wave modulation.	$ 750.00
620B	Same as above but later model.	$2200.00
626A	10 to 15GHz,10mw output power with calibrated output and pulse-square wave or FM modulation.	$4200.00
8708A	Synchronizer used with 606B,608F.The synchronizer is a phase-lock frequency stabilizer which provides crystal-oscillator frequency stability to 430MHz in the 608F signal generator.Phase locking eliminates microphonics and drift resulting in excellent frequency stability.The 8708A includes a vernier which can tune the reference oscillator over a range of +-0.25% permitting frequency settability to 2 parts in 10 to the seventh.Provides a very stable signal that satisfies many critical applications. (With HP 606B or 608F) (Without)	$ 350.00 $ 450.00
EMC-10	ELECTROMETRICS EMC-10 RFI/EMI RECEIVER Low frequency analyzer covering 20Hz to 50KHz frequency range.Extendable to 500 KHz in wideband mode.	$2500.00
NF-105F	Empire Devices Field Intensity Meter. Has NF-105/TA,NF-105/TX,NF-105/T1,NF-105/T2,NF-105/T3. Covers 14KHz to 1000MHz.	$2100.00

ALL EQUIPMENT CARRY A 30 DAY GUARANTEE.

EQUIPMENT IS NOT CALIBRATED.

UNEX LABORATORIES THS-2 FLEXICOM HEADSET.

these headsets come with data to hook up to a ICOM radios and many other equipment.

Perfect for Airplanes , Helicopters , Mobile Radios , or Just the Telephone.

These Are Factory New In Sealed Boxes. Limited Supply Only $69.95

ORDERING INSTRUCTIONS

DEFECTIVE MATERIAL: All claims for defective material must be made within sixty (60) days after receipt of parcel. All claims must include the defective material (for testing purposes), our invoice number, and the date of purchase. All returns must be packed properly or it will void all warranties.

DELIVERY: Orders are normally shipped within 48 hours after receipt of customer's order. If a part has to be backordered the customer is notified. Our normal shipping method is via First Class Mail or UPS depending on size and weight of the package. On test equipment it is by Air only, FOB shipping point.

FOREIGN ORDERS: All foreign orders must be prepaid with cashier's check or money order made out in U.S. Funds. We are sorry but C.O.D. is not available to foreign countries and Letters of Credit are not an acceptable form of payment either. Further information is available on request.

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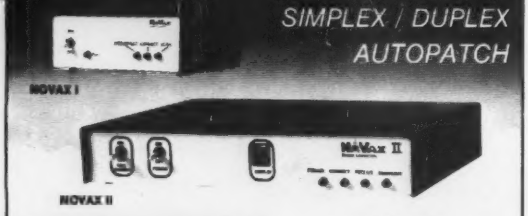

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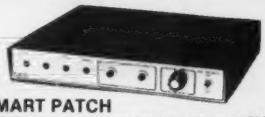

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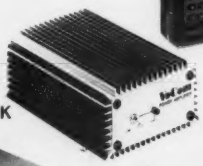

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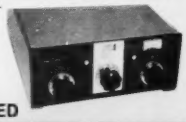

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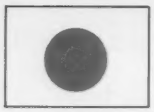
from page 92



JAPAN

Roy Waite W9PQN
Tomigaya Grand-301, 2-19-5 Tomigaya
Shibuya-Ku
Tokyo 151
Japan

AKIHABARA—PARADISE IN JAPAN

Any ham who has been to Tokyo knows about it—and probably will never forget it. Wives hate it. Anyone suffering from claustrophobia wouldn't want to go near it. But hams, and even a lot of non-hams (poor unfortunates, they are), love it and don't ever want to leave it after they get there.

What is it? It's Akihabara, pronounced "awe-key-ha-bar-a," a district of Tokyo in the northeast corner of Chiyoda ward, only 15 minutes by taxi from the center of the city. Akihabara is the electronics center of Japan, and probably of the world. It has to be seen to be believed.

There are more than 500 retail electronics shops here, offering everything currently on the electric and electronics market, including televison receivers, video recorders, tape recorders, computers, home appliances, stereo equipment, *ad infinitum*, and, of course, ham gear and parts of every description imaginable. Lots and lots of parts. It is truly mind-boggling. Even if you are not a builder, you will wish you were and maybe then and there will decide to become one.

Little stalls underneath the train tracks specialize: Several sell only knobs, another only wire, or transistors, or resistors, or transformers; one shop sells only pilot lights; another sells only aluminum chassis, boxes, and sheet aluminum. And as you walk along, you begin to notice shops that are clones of those you saw moments ago. If you couldn't find the right microphone you wanted at one shop, you can try another, and another. Is it any wonder that wives hate it? Of course, if your wife is also a ham, you'll both be broke before the day is over!

Saturdays and Sundays are the busiest days in Akihabara. Some stores close on Mondays, Wednesdays, or Thursdays.

Before the war, Akihabara was the bicycle center of Tokyo, but when the great war machine was switched on, materials became scarce and bicycle production was discontinued. After the war, a black market initially took over the district. The area did so well that electronics shops scattered around the city took note and decided to move in to take avantage of the big crowds milling around the district. That's when Akihabara began to take shape. As the economy improved, the black-market business began to fade somewhat while the electronics shops began to flourish. One by one they came, and they now dominate the area.

Daily, about 100,000 people shop here, including about 1,000 "foreigners." Many of the shops open at 10:00 am and close at 7:00 pm, so it's good to get an early start. Ham shops are not hard to locate. All you have to do is look up on the roofs for ham antenna arrays (some are magnificent!) and you've got it. Some of the stores will offer as much as 20% off list prices, but there are a few points to be careful about. First of all, the major manufacturers of ham equipment try to protect their dealers overseas. They would prefer that you buy equipment in your own country. If you buy it here, thus saving on shipping costs, the warranty may not be valid back home. Also, you'll play hell trying to get a manual in English. And the voltage here in Japan is 100, so you had better be sure that there is a 110-volt tap on the transformer. Most shops are reluctant to connect the 110-volt tap for you, so you may have to do it yourself when you get home.

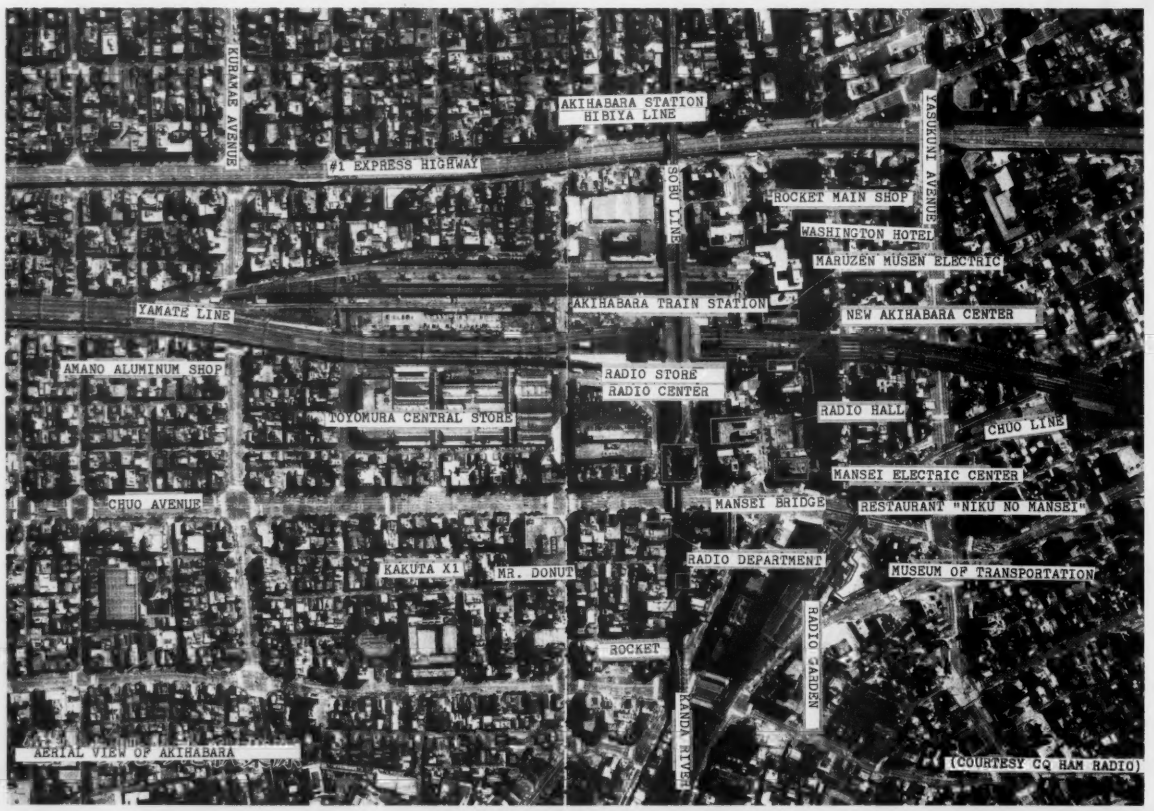
There are other pitfalls, too. The 2-meter rigs sold for use in Japan cover only 144 and 145 MHz. They are capable of operating on the full band, but you may have to make the modification yourself.

A further complicating problem is that most Japanese are not good in English, even though they will try hard to understand you. If anything really complicated comes up, you may come face to face with one of the most baffling language barriers you've ever encountered. If you can arrange it, it is best to visit Akihabara with a Japanese ham friend who speaks English or a professional interpreter, if you can afford it.

Not to be overlooked in Akihabara are the stores dealing in other electrical goods such as TVs, stereos, etc. For this purpose you will see signs displaying "Tax Free Shop," and those shops always have English-speaking people. Here you will find export models for almost everything (except ham gear). Some items will be cheaper than if purchased at "ordinary" shops, as you will be exempt from taxes. Japan does not have sales taxes as we do, but there are certain taxes that are built into the prices of certain items.

Be sure to carry your passport, since you will need it to prove that you are entitled to the tax exemption. Another reason, besides somewhat lower prices, for shopping at the tax-free shops is that they are familiar with the correct voltages and frequencies of each country. For instance, the Japanese FM broadcast band is from 76 through 90 MHz, so if you bought an FM radio in a store not selling export models, you would be stuck with a problem when you tried to use it in the US. There also are problems related to cycles, as half of Japan is on 50 cycles and the other half on 60.

If the sole purpose of your trip to Japan is to immerse yourself totally in electronics, then I would suggest you check into the Washington Hotel, right smack in the middle of Akihabara. No, George Washington hasn't slept here, but if he



Aerial view of Akihabara. (Courtesy of CQ Ham Radio*)*

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Akihabara specialty stores. (Courtesy of CQ Ham Radio*)*

had, he wouldn't have been disappointed. It is not a large hotel, but it is brand spanking new and sparkles inside. Among the conveniences of this hotel you will find a steak house and a coffee shop that serves excellent French pastries.

Apart from the Washington Hotel, there is also a restaurant called Niku-no-Mansei right at the edge of Akihabara, serving delicious steaks, hamburgers, and sukiyaki, and the prices are right! Shopping can be tiring, especially in a crowded city like Tokyo, so you will welcome a place to relax for awhile. Another place worth knowing about is Mister Donut, a branch of the US chain right in the middle of Akihabara, where you can get a cup of coffee and a donut, making your choice from over 30 different varieties. Your feet, not to mention your stomach, will be glad you came.

Back to ham-radio stores. There were about 20 at last count, but that number contracts and expands as conditions dictate. Some of the names to remember are Tomihisa, Rocket, Toyomura, and Tsukumo. Some have an occasional English-speaking clerk. For instance, at the moment, Rocket Radio has a Mr. Suzuki who can manage in English quite well. And, incidentally, Toyomura is the only store that deals solely in ham-radio equipment. All the others have branches dealing in electrical applicances, with ham radio only an afterthought.

I won't bore you here with all the details of traveling within Tokyo to get to Akihabara except to say that Akihabara is well served by trains and subways. The center of Akihabara is actually a large train station serving several lines. The subway lines are the Hibiya line and the Ginza line. Best bet is to get one of those subway and train maps that are provided free of charge at the front desk of your hotel. And you can always take a taxi, which would run not more than the yen equivalent of $5 from almost anywhere in Tokyo.

One point which should be made here is that if you do purchase a tax-free item at one of the tax-free stores, the shop clerk will put something in your passport to indicate such. Upon departing Japan, you will be required to show the merchandise that you bought as evidence that you haven't sold it at a profit. Therefore, do not pack your purchases in your luggage. Have them in your hand. Otherwise, you could be slapped with an unpleasant tax.

If you would like current information on stores, locations, and phone numbers, a good idea would be to call the Tokyo International Amateur Radio Association (TIARA) for current information. Call 947-8221 and ask for Yutaka Kasahara (JA1CLN) in the daytime, or at night call 585-2236 and ask for Joe Speroni (AH0A).

Have fun.

LIBERIA

Brother Donard Steffes, C.S.C.
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The Ministry of Post and Telecommunications and the Ministry of Transportation jointly celebrated World Communications Year with a seminar held at the University of Liberia. The seminar lasted two days. Papers presenting in-depth studies of conditions as they exist in Liberia were read and discussed.

And the amateurs were there.

The amateurs presented a paper discussing the international character of amateur radio and tried to impress the audience with the idea that the development of amateur radio in Liberia would be advantageous to the nation in many ways. The paper presented international amateur radio as the greatest self-supporting and free community service in the world.

Two aspects of this activity of service were given as examples. It was pointed out first of all that in time of real disaster, it is the amateurs who come through and set up emergency communications, sometimes within hours. The well-known story of the amateurs at work at the time of the earthquake and resultant tidal wave in Alaska was recalled. Then the story, perhaps better known in Liberia, of the Great Lhasa Fever Epidemic was related.

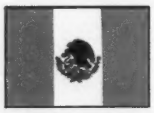
The work of amateurs in time of emergency is so important that other examples really are not needed, but amateurs are not idle when no emergency situation exists. The paper pointed out that in normal day-to-day activity, the amateurs are out there running phone patches for servicemen, furnishing communication for parades, and doing legwork for things like collecting funds for the American Cancer Society. The Red Cross also routinely utilizes the services of amateurs.

It was pointed out that amateur radio is completely noncommercial, and this aspect was developed for the benefit of the audience. The fact was stressed that all amateur services are free of charge and that amateurs in no way compete or interfere with commercial concerns.

The paper tried to impress on the audience the fact that amateurs as a group constantly study and research ways of improving communication. It stated that their record of achievements and contributions in this area are impressive.

Lastly, the friendship developed by amateurs in different countries of the world was mentioned to illustrate the fact that amateur radio promotes understanding between nations. The impact is small, but it is there. The paper made much of the fact that by and large, amateurs are really a great group of people. They are patient, considerate, and polite. They are law-abiding and, to a great extent, monitor themselves. They help each other and others. Any amateur, I think, could recite a long list of instances to illustrate these facts.

Along with the presentation of the paper, an actual amateur-radio station was set up and operated before the whole assembly. Conditions were not the best, but about six contacts were made.



MEXICO

Mark K. Toutjian XE1KMT
Apartado Postal 42-048
06470 Mexico, D.F.

I recently received a letter from Pablo A. Mooser XE1SR, president of the Mexican League of Radio Experimenters (something like the ARRL), congratulating me for the Mexico column in "*73* International." He is the author of various Spanish publications for the League and to the benefit of all Spanish-speaking hams. I was also happy to have received his informative letter with up-to-date information for the Mexico column.

At present, there are 3,240 licensed hams in this country and a total of 65 official radio clubs that are actively promoting interest in ham-related events such as communications experiments by satellite and communications via moonbounce. New licenses are constantly being authorized when individuals pass exams, which include theory, regulations, and Morse code (depending upon the type of license that is solicited). Classes are given for newcomers, dealing with theory and Morse code. It's a special occasion for local clubs to have new licensed members.

During July of this year, the Saltillo (a city in the state of Coahuila) Radio Experimenters Club celebrated its 50th anniversary. This particular radio club is considered the senior member of the Mexican League since it was the first that joined the country's Radio Experimenters League. It was a special occasion for hams nationwide. During the first ceremony of this 50th national meeting of ham-radio operators, the Aztec Diploma was awarded to Jose Luis Jimenez XE1BBF for his outstanding peformance within Mexican ham-radio operations during the past 25 years. Furthermore, the Golden Aztec Award was presented to Fernando Loyola Urquiza XE1FL, Luis Alvarez Urquiza XE1YO, and Juan Lobo y Lobo XE1A for having accomplished 50 years as ham-radio operators and in honor of their outstanding performances over the years in their support of Mexican ham radio.

Ham radio got its start in Mexico in 1926. At present, I am accumulating information pertinent to its history, with the aid of President Pablo A. Mooser, who has kindly offered to provide this and other data.

At present, I'm working on improving my own station, XE1MKT. The tower is being built and I'm purchasing the Hy-Gain TH7DX antenna. I use the Kenwood TS-13-0S barefoot. Look for me on 40–10 meters. You can find me usually around 14.307 MHz or 21.375 MHz, Wednesdays and Sundays. I'd be more than happy to answer your questions with regards to visiting Mexico and keep you informed of current events here in Mexico. Maybe with the new antenna, I'll get a better signal to you! *Saludos* from Mexico. *73* and happy DXing!

THE NETHERLANDS

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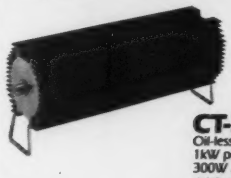

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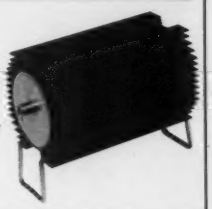

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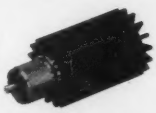

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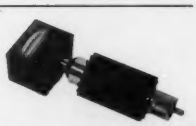

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Pieter Takens PA3BSR.

nition television system and have their own newsletter. They use homemade cameras and homemade monitors. They have also their professional standards, so that recorded pictures can be exchanged and can be transmitted (if allowed by PTT). Let me give you a sample of the capacities of the system.

Here are the NBTV standards: Lines number 32, scanned vertically upwards; picture repetition frequency—12.5 Hz, scanned right to left; line frequency—400 Hz (32 × 12.5); picture format—3 units vertical by 2 units horizontal; sync pulses (line frequency)—about 5% of the line-duration black.

The picture is basically restricted to close-ups, like a moving passport photograph. For long shots, the definition is too low. Many among you will say, what is the use of a system like this when in today's world you can buy full-color cameras and excellent TV sets and monitors!

Remember well that the practical use is very low; the main reason for building an NBTV camera and monitor is the excitement of using old techniques and to get a picture on the screen with only the very simplest and very basic methods.

It can easily be explained how the whole thing works. Most of the equipment used at present is based on the Nipkov disk. A Nipkov disk is a thin circular sheet of aluminum with a regular spiral of holes. This disk is rotated on a horizontal axis by a constant-speed motor. In front of the disk there is a lens to focus the image. Behind the disk, there is a photomultiplier or another photosensor. A simple receiver has a similar disk and a motor with accurate speed control and also a modulated light source, replacing the camera's photomultiplier. A large viewing lens replaces the camera lens.

If you're interested in NBTV, the membership of this British/Dutch club is open worldwide. The annual subscription is DFL.11 for Dutch members. Overseas subscription rates on request. Addresses for information: Treasurer: Mr. S. Kujawinski, 54 Park Drive, Hucknall, Nottingham NG15 71U, United Kingdom; Chairman: Mr. D. B. Pitt, 1 Burnwood Drive, Wollston, Nottingham, United Kingdom; Mr. A. Meyer, 'sGravenpoldersestraat 24, 4433 AH Hoedekenskerke, The Netherlands.

VHF FM ACTIVITY

The photo shows Pieter Takens PA3BSR, who is making a two-way radio contact on the 11th of July on Het Kopje van Bloemendaal, which is said to be the highest dune-top of the Netherlands. It is located near Pieter's QTH and is about 50 meters above sea level. On this spot you have a marvelous view overlooking the city of Haarlem and a part of the North Sea. Amateurs come often from miles around to take advantage of the height of the hill, located about 20 kilometers west of Amsterdam and 5 kilometers from the Dutch coast.

At the time that this photo was taken, Pieter was making a QSO with G6MOP located in Long Sutton, Norfolk (United Kingdom). The hand-held Pieter was using is a converted Storno HT with an output of 350 mW on two meters. The distance covered was 300 km! No wonder hams often go there.

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RG58AU stranded mil spec.....12¢/ft.
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RECIPROCAL LICENSING IN ZL

Countries having reciprocal license agreements with New Zealand are the Netherlands, Sweden, the United States of America, France, and Switzerland. Other countries which New Zealand has amateur-certificate recognition with are Australia, Botswana, Canada, Cook Islands, the Republic of Ireland, Papua New Guinea, Niue, the United Kingdom, and Zimbabwe.

A visitor to ZL-land from any of the above countries may obtain a visitor's license valid for 14 days by presenting a copy of his amateur certificate, his current license, and a receipt for annual fees to any of the Radio Inspector's Offices of the Regional or District Engineer's Offices of the New Zealand Post Office at Whangarei, Auckland, Hamilton, Rotorua, Gisborne, Napier, New Plymouth, Palmerston North, Masterton, Wellington, Nelson, Greymouth, Christchurch, Timaru, Dunedin, and Invercargill.

The visiting amateur will be issued with a **ZL0** callsign immediately, provided papers are in order. Each Radio Inspector's Office has its individual allotment of **ZL0** callsigns for immediate issue to the 14-day-visitor licensees.

Should the visitor want to stay longer than 14 days, then he must make written application, sending copies of his amateur certificate and current license information so that they are received by the Radio Inspector's Office where he wishes to pick up his visitor's **ZL0** call one month before the date the visitor's license is required.

This longer-period **ZL0** call for visitors is issued from Post Office Headquarters, Wellington, and is valid for periods of over 14 days and up to one year from the date of issue. The long-term-visitor's **ZL0** license is renewable, but after the first year, a normal resident-ZL callsign will be issued in place of the visitor's **ZL0** call.

As an example—a visitor using the callsign **ZL0**XXX/W6 has the prefix of his home call given after the slash following the **ZL0** call.

BITS 'N' PIECES

Packet radio (*73*, September, 1983) was used in ZL recently for traffic handling during the recent 24-hour telethon held to raise money for charitable purposes. The Amateur Radio Emergency Corps was asked to provide communication nets for the transmission of pledge messages advising the amounts of money donated, and our regulatory authority, the New Zea-

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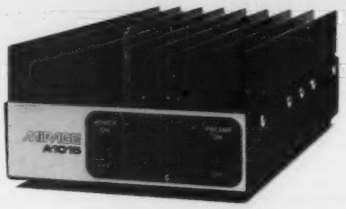

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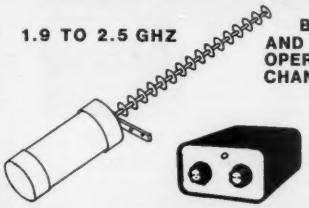

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land Post Office, allowed the NZART AREC to use the occasion as a 24-hour traffic-handling exercise for the amateur emergency nets around the country.

In most areas, VHF/HF traffic nets were used, but at one of the regional telethon centers, Palmerston North, a group of interested amateurs with a mutual interest in packet radio decided to use the Manawatu data repeater to relay the telethon information. Three branches, Dannevirke, Pahiatua, and Hawera, used the system.

The pledge messages were entered in groups of five to ten at a time into the computer, compiled into a standard text form, and sent by dataicom (packet radio) via the Manawatu data repeater to a Palmerston North home station, where the demodulated signal was fed into another 6809 computer system, printed out, and delivered to the Central Region Telethon Center. The computers used were Motorola user-group 6809 systems, combining keyboard, computer disk drive, and a user-group modem to couple the VHF transceiver. A local printer was used for the hard copy, although the message files were held on magnetic disk. The whole system was never pushed and could have handled a lot more traffic if it had been available, despite the slow typing speed of most operators.

As luck would have it, the Palmerston North data-station operator lived just over the road from the stadium where the Central Region Telethon Center was located, so the printouts were delivered from time to time by hand.

Participating operators were ZLs 2AYF, 2BNP, and 2TPQ from Dannevirke, ZLs 2TDA, 2TDB, 2TOU, and 2TXC from Woodville, and ZL2TMD, the base station at Palmerston North.

Hamfests, swap and shops, swapfests, flea markets, and swapventions are some of the names of North American activities where amateurs get together and buy or sell their used equipment. They are the source of bargains galore and a place where hams can meet, socialize, and fraternize. Down under in ZL-land, we have another name for these functions, and they operate on a different selling system than on the North American scene. In New Zealand, we call these functions "junk sales"...an occasion where the average ham can clean out the workshop of all surplus equipment, some of it junk, and usually some of it that he purchased at the last junk sale attended. In one or two areas, the junk sales are a little more sophisticated, as they have trading tables and displays of the latest new equipment available by the local representatives of the name overseas manufacturers of amateur equipment. There is also at least one area where a flea market just like those in the US and Canada is organized.

Let's take a closer look at a ZL junk sale.

They are always organized by one of the local branches of NZART (clubs). The branch committee first looks at the year's schedule of junk sales and selects a time which does not clash with another nearby district's sale. Once the date has been set, then an auctioneer must be obtained (and there are one or two good ones within our amateur ranks)—one with sympathetic leanings towards amateur radio. The auctioneer's services are not free of charge, but they cost only an honorary payment.

Next is the venue, a local hall in a central position with plenty of parking space, as amateurs will be coming from as far as 200 miles away. In some very extreme cases, amateurs bitten by the junk-sale bug have been known to travel 500 miles to attend a sale.

Then come the administrative arrangements, the catering arrangements (coffee breaks and lunch), the financial arrangements, and the gathering of the necessary branch members to staff the various departments on the day of the sale. Somewhere between 20 and 30 helpers are needed to run the day properly.

On the day of the junk sale, the various "lots" are presented for recording on the auction forms, and the vendor is given a receipt for his/her surplus equipment (junk). An an average ZL junk sale, there are about three to four hundred lots for auction during the course of a 7- or 8-hour auction period. Selling starts about 9:30 or 10 am and continues nonstop until the lunch break around 12:30 pm. Selling resumes again about 1 pm, continuing nonstop until all the lots have been sold, maybe around 5 pm.

Sales are made on a commission basis, the organizing club getting the commissions charged—usually 15% for their club funds. The range of items for sale covers from *absolute* junk through to near-new transceivers, and in some cases, brand-new components or accessories that have been purchased but never used.

Before the sale starts, the lots are available for inspection up until the time the auction commences, and again at the lunch break, but not during the auction periods.

Besides the auction sale, there are trading tables organized by the club committee, direct-selling small bags of components and/or anything saleable that does not conflict with the auction. Club committees scour the sources of cheap components and then have working bees (collective working parties of members) to bag up the items into saleable quantities. Your correspondent has been counting out 32,000 ½-Watt resistors into 10s and twisting the tails together for what seems like days in preparation for our junk sale to be held soon. My fingers are a bit sore and I'm counting tens in my sleep. The final stage of this working bee will be to bag up the resistors into bags of 32 values, 10 of each value, for sale on the trading table.

On the social side, a junk sale provides the opportunity for a large number of amateurs to congregate together for at least a whole day, and in some cases, where hams travel some distance, possibly overnight, to swap the usual amateur stories of the DX they have worked, etc. Junk sales are great happenings on the ham scene here in ZL; they are occasions when one can empty out the shack or workshop of all that surplus gear you have accumulated over the past year or so and a time when you can go looking for that special piece you need to complete the project you have in mind. It is also one of those times for some amateurs when they bring home more junk than they took to the sale.

ZL junk sales have their regular followers who travel considerable distances to be present and participate in the day's activities, both business and social. From the number on the year's program, they seem to be on the increase in popularity. Each year we see new ones starting up in areas not previously catered to by the sales already operating.

Awards: For certificate hunters, a little bit of advance information on a special award—the City of Hastings Centennial Award—to celebrate the 100th birthday of Hastings, a city of about 50,000 population located in Hawkes Bay, North Island of ZL. The award will be available during the month of February, 1984, all bands, all modes, and those working the required number of stations will receive a handsome colored certificate for their efforts. Details of the requirements will be included in next month's column, in sufficient time for those wishing to participate. Information will also be circulated on most of the overseas nets, but if you miss out, do not hesitate to write to me. Please remember to include 2 IRCs for a reply by aerogramme so that you get the information in time to participate for this special award.

Well, that's about all for this month, as I have to clean out the shack and workshop to get ready for the club junk sale next Saturday. Maybe I'll make enough from my sales to buy that rotary coil I need for the ATU I'm planning. Or maybe I'll be lucky and pick up a whole ATU at a reasonable price. See you all next month.

SWEDEN

Rune Wande SMØCOP
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THE MATCH TOWN AWARD

In 1984, the city of Jonkoping in southern Sweden celebrates its 700-year anniversary. The Swedish chemist Gustav E. Pasch (1788–1862) got a patent in 1844 on his invention of the first safety matches. In 1852, a Swedish manufacturer, John Lundstrom, began to produce them in large quantities in Jonkoping. Between 1916 and 1929, the Swedish export for safety matches was 50 million kilograms annually. Today the Swedish Match Company is a giant international diversified empire that owns factories, forests, mines, and oil wells.

The Match Town Award is a beautiful silk streamer in several colors. You should contact radio amateurs in the Jonkoping community (F6 for the Swedish Commune Award) during the calendar year of 1984. The award is issued by the radio club SVARK, Sodra Vatterbygdens Amatorradioklubb. Every QSO with Jonkoping Commune counts as 1 point. The club station, SK7AX, counts as 2 points. Points required for the award: SM = 4 points, Europeans = 3 points, and DX = 2 points. There is no requirement for QSL cards as proof for contact. The necessary verification can easily be done by the club. Just give the regular QSO data in your application.

Application shall be made to SVARK, PO Box 2035, S-561 02 Huskvarna, Sweden. The fee is either 30 Swedish kroner, 10 IRCs, or US$5.00.

PREFIX OF

Finland has joined the countries that celebrate the 1983 World Communications Year by issuing a special prefix. Between November 18 and December 18, 1983, any Finnish radio amateur can switch the regular OH to the OF prefix.

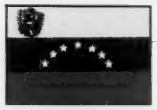
FINNISH *SISU*

The Finns are known for having extraordinary stamina and endurance, called *sisu*. For the 1982 CQ WW DX contest, the club of OH2s, OH2AA, put up a contest effort in order to beat the European record.

The station was OHØW from the Aland Islands, Finnish islands close to Sweden both geographically and linguistically. They have a special status and are a separate DXCC country. On their QSL card, the contest group at OHØW sent a message to all fellow contesters that said:

"We were all born in Finland—a country on the Arctic Circle. It is a country we love, we are even proud of it. We are used to a weather of four seasons—from a swimming July to a freezing February, from a gently awakening April to a reclining October. We are even fortunate enough to have the world's most beautiful archipelago, reaching all the way to the easternmost of the Aland Islands, the OHØ. So, why don't we make it from here—be fanatic enough to perfect every bit of action and bring together all the Finns around the fireworks. And win the world from the north of Europe—that's what OHØW was all about. It included 60 potent hams, each given the most suitable assignment, best equipment, massive KLM hardware, all built up in what still is a rare one—OHØ. It was crazy all the way through. A storm kept taking down the antennas at the rate we were raising them; the conditions were poor just as the antennas were good and it was like 60 men fighting against the power of Mother Nature. It was kind of fun, however—a once in a lifetime experience—fun you would never repeat. It was 30,000 QSOs in 130 hours and a new European record with a comfortable margin. We are Finns—that's why we go for all this."

The equipment included Yaesu and Drake Twins, Henry and DenTron linears; KLM 6-el Big Stickers and Hy-Gain 5-el monobanders were mounted on seven 100-foot towers made by OH8QD. For the low bands, some highly advanced multiple loops and 1/4-wave verticals laid out straight in the ocean. All in all, the installation required some 3,000 feet of RG-8/U cable. As additional help, they had intercoms, radiotelephones, 25 IC-2E handhelds, and even a helicopter! Maybe this *sisu* makes them always able to beat the Swedes and the other Nordic countries in the Scandinavian Activity Contest as well as the NRAU, Nordic Radio Amateur Union Contest, every year!



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Caracas 1061-A
Venezuela

During my last trip to California, I bought a Lunar GaAsFET preamplifier for my Kenwood TR-9130. It was intended to be used for satellite work. Back in Caracas, the preamp was tested and worked like a dream. In fact, it is worth every cent of the US$170 price tag. I have installed this amplifier at several repeater sites in commercial VHF and UHF repeaters and the result is not only more sensitive receivers, but less intermodulation, too. In the commercial installations, I used a crystal filter ahead to improve selectivity. After playing with the jewel, I realized that it was dangerous to use the preamp in a transceiver with no protection against rf power that would be fed through the input. You may destroy the GaAsFET in a blink if the PTT is accidentally pressed, if only for a fraction of a second.

I devised a gadget that would disable the transmitter once the preamp is connected to the transceiver antenna plug. The simplest way I could figure out to do it was to place a ring in a PL-259 plug in such a way that, once plugged in, it served as a lever to actuate a microswitch that ultimately will be used to break the PTT line.

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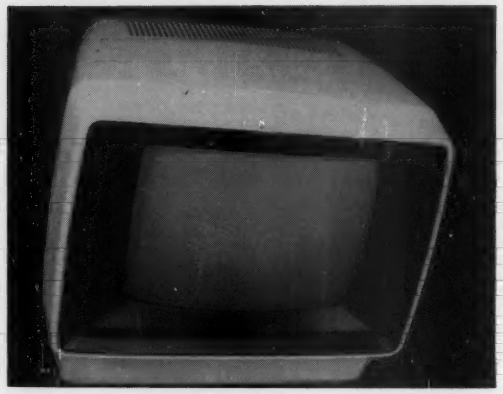

Another super deal by Meshna ! We acquired a limited number of these beautifully made, super intelligent computer terminals. They were made by one of the largest computer companies in the world. The name has been witheld by request of the manufacturer, but you will recognize it when you see the terminal. Each terminal comes with its own 106 key keyboard and monitor which houses 2 of the systems micro-processors, memory system, and 115 vac switching power supply. There are far too many features to list here, but here are just a few : 3 micro-processors (2 in the monitor & 1 in the keyboard), 16K RAM, 48K ROM, EAROM (which is programmable by the keyboard), serial RS 232 asynchronous communications (synchronous optional), selectable baud rates (75-19.2K BPS), high resolution, green screen display with reverse video option, 80 x 25 line scrolling display, expandable character font (40 x 25 lines), built in 115 vac regulated, switching power supply, and much, much more. Most units are new in original factory cartons, but sold "as is." Each system comes with an operators manual. At our ridiculously low price, how can you lose ?
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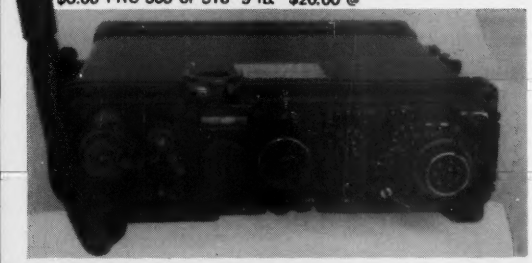
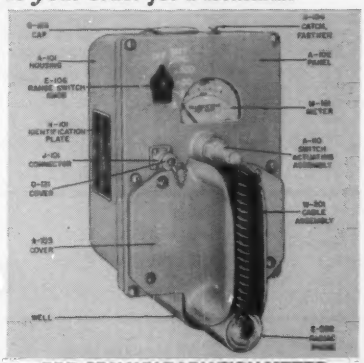
We just purchased a nice, clean lot of surplus Canadian military PRC 509 & PRC 510 radios. They are similiar to US PRC 9A & 10A. 900 milliwatt output will transmit an average of 5 miles over a tuneable range of 27-39 MHz (PRC 509) and 38 55 MHz (PRC 510). For best operation the handset and antenna listed below should be used with the radio, but you can always jury rig your own. Radios are whole, untested and sold as is. Each one comes with free battery box (batteries not included) and schematic. Front panel controls marked for easy operations. Accessories available H-33 handset (mic & earphone) $12.00, semi-rigid anatenna $5.00, 4300 MHz calibration crystal $3.00 (not necessary for normal operation), & military operations handbook $3.00 PRC 509 or 510 9 lb. $20.00 @





PDR-27 NAVY RADIATION METER

Just released by the US Navy. They appear to be in excellent condition and include the fitted aluminum transit case. Batteries not furnished but are available in most electronic supply houses. 4 ranges 0.5 to 500 mr/hr. Removeable hand probe, detection of Beta and Gamma radiation. With todays world conditions and perhaps proximity to a nuke power station, it might provide a little insurance to own one of these instruments. With no facilities to check or test, we offer AS IS, visually OK Schematic provided with each. We have some accessories and offer as an option although not required for operation.
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The best way to do the task is to break the line going to pin 7 at plug 13 in the drive unit and place a normally-closed microswitch in between. As the microswitch would be externally installed, the wires connected to it would also be routed outside the radio. I planned to use either of the available auxiliary jacks at the unit rear panel, since I don't like to drill holes in equipment when doing modifications unless there is no other practical way. Should you desire to restore the unit, then it is easy to reverse the procedure, and everything remains as new. Finally, the special PL-259 would be fitted to a short piece of RG-58/U with a BNC male connector at the other end. The BNC connector may then be plugged to the preamp and when you wish to work the satellites, the modified plug would be safely connected to the transceiver and automatically the PTT would be disabled.

That was a planned project and remained like that. Then, yes, it happened. On June 16, I heard OSCAR 10 and hastily plugged in the preamp; the OSCAR 10 beacon came in loud and clear. Two seconds later, the GaAsFET was burned by an accidental touch of the PTT button...

REQUIREMENTS FOR A RECIPROCAL LICENSE

You must request a license from the Ministerio de Transporte y Comunicaciones (form FC-1). The form has 21 boxes to be filled in as follows:

1. Your name and address in your country.
2. In this box you must specify the kind of station you are applying for: AT-F for fixed stations, AT-M for mobile stations, AT-P for portable stations. You must use separate forms for each type of station.

2b. You should specify AFIC (contraction of amateur).

3a. 1 kW.

8a. Base-station address.

8b. City corresponding to above address.

8c. State corresponding to above city.

9a. Make and model of vehicle, if mobile.

9b. Plate or registration number of above vehicle.

9c. "Area del Territorio Nacional."

12. "Instalacion."

18. Your birthplace and date, city, country, nationality, place and date of the application, and signature.

21. In this box you must specify the reason for your application for an amateur license.

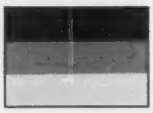
Note: Do not fill in boxes 2c, 2d, 4a, 6d, and 7.

You must also include a photocopy of your license and evidence of good standing. A letter stating the reasons for the application is also necessary, along with a photocopy of your passport and visa. You must include a stamp of Bs. 1.00.

The address, if you send the form by mail, is: Ministerio de Transporte y Comunicaciones, Direccion General Sectorial de Comunicaciones, Direccion de Ingenieria, Edificio Centro de Valores, Piso 6 Oficina 6-4, Luneta a Caja de Agua, Caracas 1010, Venezuela. Don't be afraid—addresses are quite long down here in Caracas.

The only problem you may have is that you must apply for the type of station you intend to use: fixed station, mobile station, or portable station. This means that if you intend to operate mobile, you must include vehicle references which may be almost impossible to get if you are going to rent a car. Even when fixed station is your choice, you must know in advance the place where you will be staying. Maybe the portable license is the best choice, in case you carry an HT. If you plan to operate both fixed and mobile, you must apply for both licenses separately.

The best procedure, officially recommended, is to have somebody here, friend or relative, help you with the application. Normally it should take 20 days, but sometimes things go more slowly.



WEST GERMANY

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Hammarskjold-Ring 174
D 6000, Frankfurt 50
West Germany

DLD AWARDS

The "Deutschland Diplom," DLD

The DLD was introduced by the Deutscher Amateur Radio Club (DARC) on September 1, 1956. It is awarded in two classes, DLD 100 and DLD 200. German and European radio amateurs get the DLD 100 for QSOs on the 80m band only. Radio amateurs of non-European countries get the DLD for QSOs on 80, 20, 15, and 10 meters (mixed). QSOs on 80 meters will be counted twice. Only QSOs since January 1, 1956, are taken into consideration for the DLD.

The "Deutschland Diplom 40-Meter," DLD 40-Meter

The DLD 40-Meter was introduced on May 7, 1959. It is also awarded in two classes, DLD 100/40-Meter and DLD 200/40-Meter. The DLD 40-Meter can be obtained for QSOs on the 40m band. Only QSOs since May 7, 1959, are taken into consideration for the DLD 40-Meter.

Proficiency Badges

The DLD proficiency badges are awarded upon application. The badges will be issued in three classes: *bronze* for DLD 300 (300 confirmed DOKs), *silver* for DLD 400 (400 confirmed DOKs), and *gold* for DLD 500 (500 confirmed DOKs). Note: Blocks of full 100 DOKs per each band must be shown. For example, the bronze badge (DLD 300) may be obtained for any of the following combinations: DLD 100 and DLD 200/40-Meter; DLD 200 and DLD 100/40-meter; DLD 200 and 100 additional confirmed DOKs on 80 meters only; DLD 200/40-Meter and 100 confirmed additional DOKs on 40 meters only. The silver and gold badges are available for analogous combinations.

Stickers

Holders of the DLD 500 may get stickers upon application. These stickers are issued in four classes: *green* for 600 confirmed DOKs, *red* for 700 confirmed DOKs, *silver* for 800 confirmed DOKs, and *gold* for 900 confirmed DOKs. For these classes, the DOKs are summed up regardless of the band (DLD plus DLD 40-Meter).

The "Deutschland Diplom 1000," DLD 1000

Holders of the DLD 500 and any sticker up to 900 may obtain the highest class of the DLD awards, the DLD 1000. Therefore, it is necessary to present the remaining DOKs on 80 and 40 meters (European radio amateurs) or on 80, 40, 20, 15, and/or 10 meters (non-European radio amateurs).

Requirements

DOK means "Distrikts-Ortsverbands-Kenner" (district area indictor). The DOK must be shown in printed form on the QSL cards. Official DARC stamps are admissible for substitution.

There are no restrictions in type or mode of transmitting. The DLD will be awarded if the applicant presents QSL cards with at least 100 different DOKs on a single band only (non-European amateurs on 80, 40, 20, 15, and/or 10).

The fees for DLD awards are as follows: DLD 100, DLD 200, DLD 100/40-Meter, DLD 200/40-Meter, Bronze badge (DLD 300), and DLD 1000—10 DM or 15 IRCs each; Silver badge (DLD 400)—12 DM or 20 IRCs; Gold badge (DLD 500)—15 DM or 25 IRCs; any sticker from 600 up to 900—5 DM or 10 IRCs. The fees should be enclosed with application.

All applications are handled by the "Referat fuer Funkbetrieb" (section for amateur-service operations of DARC). The holders of DLD awards will be published regularly in *cq-DL*, the official club magazine of DARC. Applications accompanied by the original QSLs should be addressed to: H. P. Guenther DL9XW, Am Strampel 22, D-4460 Nordhorn, W. Germany. Note: On request, special applications forms for the DLD awards are available.

The "Deutschland Diplom 10-Meter," DLD 10-Meter

The DLD 10-Meter was inaugurated by the Deutscher Amateur Radio Club (DARC), to liven up the 10m band. Its purpose is to save this band for amateur-radio traffic.

The DLD 10-Meter can be acquired by all radio amateurs holding a license. It will be awarded in the basic class by presenting necessary QSL cards for 50 different DOKs on the 10m band only. Only two-way contacts since January 1, 1976, are taken into consideration. There are no restrictions in the type or mode of transmitting. Endorsement stickers are available for each additional 25 different DOKs worked exclusively on 10-meters.

For the DLD 10-Meter, only those cards which show the DOK in printing can be accepted. Official DARC stamps are admissible for substitution. The fees for the basic award are 10 DM or 15 IRCs; for any additional sticker, the fee is 5 DM or 10 IRCs.

All applications are handled by the "Referat fuer Funkbetrieb" (section for amateur-service operations of DARC). For the handling of the DLD 10-Meter, special application forms are necessary. They can be obtained from DL9XW.

CORRECTIONS

In "Six Antennas from Three Wires," which began on p. 10 of the October, 1983, issue, an incorrect variable was used in the formula for return loss on p. 14. In that formula, "R1" should be "RL."

"New England's Nicad Per-Charger," which appeared in the April, 1983, issue of *73*, contained two errors. In Fig. 1 on p. 39, switch S1A was incorrectly drawn. The common switch lead should be connected to the positive meter line. And in the text, PL2 was mistakenly referred to as J1.

Avery L. Jenkins WB8JLG
***73* Staff**

FCC

Bowing to pressure from several amateur organizations wishing to rebroadcast the STS-9 shuttle flight, the FCC waived prohibitions against all such transmissions. The Commission added that rebroadcasting would give amateurs experience in space-Earth linking, a skill which may become important in disaster and emergency communications.

The following is a summary of the FCC's decision as it appeared in the *Federal Register*.

Amateur Radio Service Rules; Waiver

AGENCY: Federal Communications Commission.

ACTION: Rule Waiver.

SUMMARY: This document grants a rule waiver to permit retransmission by any licensed amateur radio operator of Space Shuttle audio and video communications on amateur radio frequencies for the exclusive use of licensed amateur radio operators. The waiver is necessary in order to obviate individual waiver requests for each scheduled Space Shuttle flight. By this rule waiver, amateur radio operators will gain experience in establishing *ad hoc* radio links and networks to carry the Space Shuttle information to amateur radio licensees, thereby increasing their technical skills for handling disaster and emergency communication.

STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION (Required by 39 U.S.C. 3685). 1. Title of publication, *73 Amateur Radio's Technical Journal*. A. Publication no. ISSN 0745080X. 2. Date of filing, Oct. 1, 1983. 3. Frequency of issue, Monthly. A. No. of issues published annually, 12. B. Annual subscription price, $25.00. 4. Location of known office of publication (Street, City, County, State and ZIP Code) (Not printers), 80 Pine Street, Peterborough, Hillsborough County, N.H. 03458. 5. Location of the headquarters or general business offices of the publishers (Not printers), 80 Pine Street, Peterborough, Hillsborough County, N.H. 03458. 6. Names and complete addresses of publisher, editor and managing editor. Publisher (Name and Address), Wayne Green, 80 Pine Street, Peterborough, N.H. 03458. Editor (Name and Address), Wayne Green, 80 Pine Street, Peterborough, N.H. 03458. Managing Editor (Name and Address), Jack Burnett, 12C Granite St., Peterborough, N.H. 03458. 7. Owner (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual must be given. If the publication is published by a nonprofit organization, its name and address must be stated.) Name, International Data Group, PO Box 1450, 5 Speen St., Framingham MA 01701. Patrick J. McGovern, PO Box 1450, 5 Speen St., Framingham, MA 01701. 8. Known bondholders, mortgagees and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages or other securities (If there are none, so state) Name, none. 9. For completion by nonprofit organizations authorized to mail at special rates (Section 411.3, DMM only). The purpose, function and nonprofit status of this organization and the exempt status for Federal income tax purposes (check one) Not applicable. 10. Extent and nature of circulation. (X) Average No. copies each issue during preceding 12 months. (Y) Actual No. copies of single issue published nearest to filing date. A. Total No. of copies printed (Net Press Run) (X) 62,532 (Y) 64,594. B. Paid circulation 1. Sales through dealers and carriers, street vendors and counters sales, (X) 11,512 (Y) 17,192. 2. Mail subscriptions (X) 42,162 (Y) 38,638 C. Total paid circulation (Sum of 10B1 and 10B2) (X) 53,674 (Y) 57,031. El Free distribution by mail, carrier or other means, samples, complimentary, and other free copies (X) 446 (Y) 479. E. Total distribution (Sum of C and D) (X) 54,122 (Y) 57,510. F. Copies not distributed 1. Office use, left over, unaccounted, spoiled after printing (X) 4,347 (Y) 7,084. 2. Returns from news agents (X) 4,063 (Y) 0 G. Total (Sum of E, F1 and 2—should equal net press run shown in A) (X) 62,532 (Y) 64,594. 11. I certify that the statements made by me above are correct and complete. Signature and title of editor, publisher, business manager, or owner. Debra Wetherbee, Vice President/General Manager.

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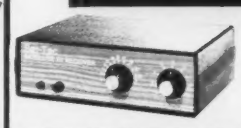

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Trimmer Caps

Sprague - 3-40 pf Stable Polypropylene **.50 ea.**

Crystal Microphone

Small 1" diameter ¼" thick crystal mike cartridge **$.75**

Mini RG-174 Coax

10 ft. for $1.00

Coax Connector

Chassis mount BNC type **$1.00**

9 Volt Battery Clips

Nice quality clips **5 for $1.00**
¾" Rubber Grommets **10 for $1.00**

Parts Bag

Asst. of chokes, disc caps, tant. resistors, transistors, diodes, MICA caps etc. sm. bag (100 pc) **$1.00** lg. bag (300 pc) **$2.50**

Connectors

6 pin type gold contacts for mA-1003 car clock module price **.75 ea.**

Leds

- your choice, please specify
Mini Red, Jumbo Red, High Intensity Red, Illuminator Red **8/$1**
Mini Yellow, Jumbo Yellow, Jumbo Green **6/$1**

Varactors

Motorola MV 2209 30 PF Nominal cap 20-80 PF - Tunable range - **.50 each or 3/$1.00**

Crystals

3.579545 MHZ	$1.50
10.00000 MHZ	$5.00
5.248800 MHZ	$5.00

AC Adapters

Good for clocks, nicad chargers, all 110 VAC plug one end

8.5 vdc @ 20 mA	$1.00
16 vac @ 160mA	$2.50
12 vac @ 250mA	$3.00

Audio Prescaler

Make high resolution audio measurments, great for musical instrument tuning, PL tones, etc. Multiplies audio UP in frequency, selectable x10 or x100, gives .01 HZ resolution with 1 sec. gate time! High sensitivity of 25 mv, 1 meg input z and built-in filtering gives great performance. Runs on 9V battery, all CMOS.

PS-2 kit **$29.95**
PS-2 wired **$39.95**

600 MHz PRESCALER

Extend the range of your counter to 600 MHz. Works with all counters. Less than 150 mv sensitivity. specify -10 or -100

Wired, tested, PS-1B **$59.95**
Kit, PS-1B **$44.95**

30 Watt 2 mtr PWR AMP

Simple Class C power amp features 8 times power gain. 1 W in for 8 out, 2 W in for 15 out, 4W in for 30 out. Max output of 35 W, incredible value, complete with all parts, less case and T-R relay.

PA-1, 30 W pwr amp kit **$22.95**
TR-1, RF sensed T-R relay kit **6.95**

MRF-238 transistor as used in PA-1 8-10db gain 150 mhz **$11.95**

Power Supply Kit

Complete triple regulated power supply provides variable 6 to 18 volts at 200 ma and +5 at 1 Amp. Excellent load regulation, good filtering and small size. Less transformers, requires 6.3 V /a 1 A and 24 VCT. Complete kit, PS-3LT **$6.95**

RF actuated relay senses RF (1W) and closes DPDT relay. For RF sensed T-R relay TR-1 Kit **$6.95**

OP-AMP Special

BI-FET LF 13741 - Direct pin for pin 741 co[illegible] but 500,000 MEG input z, super low 50 pa input curre[illegible] power drain.

50 for only $9.00 SOLD OUT **10 for $2.00**

Regulators

78MG	$1.25	7812	$1.00
79MG	$1.25	7815	$1.00
723	$.50	7905	$1.25
309K	$1.15	7912	$1.25
7805	$1.00	7915	$1.25

Shrink Tubing Nubs

Nice precut pces of shrink size 1" x ¼" shrink to ⅛". Great for splices. **50/$1.00**

Mini TO-92 Heat Sinks

Thermalloy Brand TO-220 Heat Sinks **5 for $1.00** **3 for $1.00**

Opto Isolators - 4N28 type **$.50 ea.**
Opto Reflectors - Photo diode + LED **$1.00 ea.**

Molex Pins

Molex already precut in length of 7. Perfect for 14 pin sockets. **20 strips for $1.00**

CDS Photocells

Resistance varies with light, 250 ohms to over 3 meg **3 for $1.00**

See List of Advertisers on page 130

THE MOST AFFORDABLE REPEATER

ALSO HAS THE MOST IMPRESSIVE PERFORMANCE FEATURES

(AND GIVES THEM TO YOU AS STANDARD EQUIPMENT!)

JUST LOOK AT THESE PRICES!

Band	Kit	Wired/Tested
10M,6M,2M,220	$680	$880
440	$780	$980

Both kit and wired units are complete with all parts, modules, hardware, and crystals.

CALL OR WRITE FOR COMPLETE DETAILS.

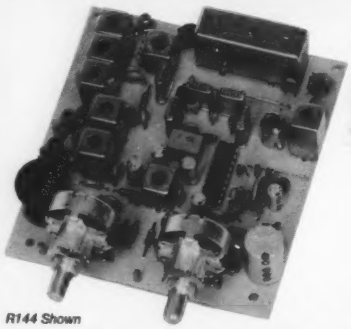
Also available for remote site linking, crossband, and remote base.

FEATURES:

- SENSITIVITY SECOND TO NONE; TYPICALLY 0.15 uV ON VHF, 0.3 uV ON UHF.
- SELECTIVITY THAT CAN'T BE BEAT! BOTH 8 POLE CRYSTAL FILTER & CERAMIC FILTER FOR GREATER THAN 100 dB AT ± 12KHZ. HELICAL RESONATOR FRONT ENDS. SEE R144, R220, AND R451 SPECS IN RECEIVER AD BELOW.
- OTHER GREAT RECEIVER FEATURES: FLUTTER-PROOF SQUELCH, AFC TO COMPENSATE FOR OFF-FREQ TRANSMITTERS, SEPARATE LOCAL SPEAKER AMPLIFIER & CONTROL.
- CLEAN, EASY TUNE TRANSMITTER; UP TO 20 WATTS OUT (UP TO 50W WITH OPTIONAL PA).

HIGH QUALITY MODULES FOR REPEATERS, LINKS, TELEMETRY, ETC.

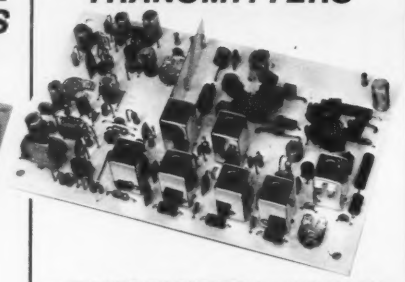
HIGH-PERFORMANCE RECEIVER MODULES



R144 Shown

- **R144/R220 FM RCVRS** for 2M or 220 MHz. 0.15uV sens.; 8 pole xtal filter & ceramic filter in i-f, helical resonator front end for exceptional selectivity, more than −100 dB at ±12 kHz, best available today. Flutter-proof squelch. AFC tracks drifting xmtrs. Xtal oven avail. Kit only $138.
- **R451 FM RCVR** Same but for uhf. Tuned line front end, 0.3 uV sens. Kit only $138.
- **R76 FM RCVR** for 10M, 6M, 2M, 220, or commercial bands. As above, but w/o AFC or hel. res. Kits only $118. Also avail w/4 pole filter, only $98/kit.
- **R110 VHF AM RECEIVER** kit for VHF aircraft band or ham bands. Only $98.
- **R110-259 SPACE SHUTTLE RECEIVER,** kit only $98.

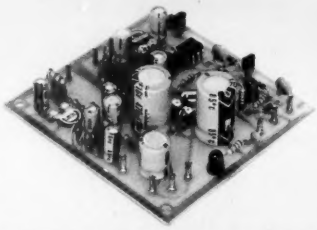
TRANSMITTERS



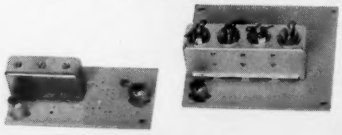
- **T51 VHF FM EXCITER** for 10M, 6M, 2M, 220 MHz or adjacent bands. 2 Watts continuous, up to 2½ W intermittent. $68/kit.

- **T451 UHF FM EXCITER** 2 to 3 Watts on 450 ham band or adjacent freq. Kit only $78.
- **VHF & UHF LINEAR AMPLIFIERS.** Use on either FM or SSB. Power levels from 10 to 45 Watts to go with exciters & xmtg converters. Several models. Kits from $78.
- **A16 RF TIGHT BOX** Deep drawn alum. case with tight cover and no seams. 7 x 8 x 2 inches. Designed especially for repeaters. $20.

ACCESSORIES



- **COR KITS** With Audio mixer, speaker amplifier, tail & time out timers. Kit only $38.
- **CWID KITS** 158 bits, field programmable, clean audio, rugged TTL logic. Kit only $68.
- **DTMF DECODER/CONTROLLER KITS.** Control 2 separate on/off functions with touchtones®, e.g., repeater and autopatch. Use with main or aux. receiver or with Autopatch. Only $90
- **AUTOPATCH KITS.** Provide repeater autopatch, reverse patch, phone line remote control of repeater, secondary control via repeater receiver. Many other features. Only $90. Requires DTMF Module.



- **HELICAL RESONATOR FILTERS** available separately on pcb w/connectors.

HRF-144 for 143-150 MHz	$38
HRF-220 for 213-233 MHz	$38
HRF-432 for 420-450 MHz	$48

hamtronics® 33

NEW LOW-NOISE PREAMPS

New low-noise microwave transistors make preamps in the 0.9 to 1.0 dB noise figure range possible without the fragility and power supply problems of gas-fet's. Units furnished wired and tuned to ham band. Can be easily retuned to nearby freq.

Models LNA( ), P30, and P432 shown

Model	Tunable Freq Range	Noise Figure	Gain	Price
LNA 28	20-40	0.9 dB	20 dB	$39
LNA 50	40-70	0.9 dB	20 dB	$39
LNA 144	120-180	1.0 dB	18 dB	$39
LNA 220	180-250	1.0 dB	17 dB	$39
LNA 432	380-470	1.0 dB	18 dB	$45
LNA 800	470-960	1.2dB	15 dB	$45

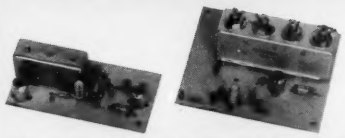
ECONOMY PREAMPS

Our traditional preamps, proven in years of service. Over 20,000 in use throughout the world. Tuneable over narrow range. Specify exact freq. band needed. Gain 16-20 dB. NF = 2 dB or less. VHF units available 27 to 300 MHz. UHF units available 300 to 650 MHz.

- P30K, VHF Kit less case $18
- P30W, VHF Wired/Tested $33
- P432K, UHF Kit less case $21
- P432W, UHF Wired/Tested $36

P432 also available in broadband version to cover 20-650 MHz without tuning. Same price as P432; add "B" to model #.

HELICAL RESONATOR PREAMPS



Our lab has developed a new line of low-noise receiver preamps with helical resonator filters built in. The combination of a low noise amplifier similar to the LNA series and the sharp selectivity of a 3 or 4 section helical resonator provides increased sensitivity while reducing intermod and cross-band interference in critical applications. See selectivity curves at right. Noise figure = 1 to 1.2 dB. Gain = 12 to 15 dB.

Model	Tuning Range	Price
HRA-144	143-150 MHz	$49
HRA-220	213-233 MHz	$49
HRA-432	420-450 MHz	$59
HRA-( )	150-174MHz	$69
HRA-( )	450-470 MHz	$79

RECEIVING CONVERTERS

Models to cover every practical rf & if range to listen to SSB, FM, ATV, etc. NF = 2 dB or less.

	Antenna Input Range	Receiver Output
VHF MODELS	28-32	144-148
	50-52	28-30
Kit with Case $49	50-54	144-148
Less Case $39	144-146	28-30
Wired $69	145-147	28-30
	144-144.4	27-27.4
	146-148	28-30
	144-148	50-54
	220-222	28-30
	220-224	144-148
	222-226	144-148
	220-224	50-54
	222-224	28-30
UHF MODELS	432-434	28-30
	435-437	28-30
Kit with Case $59	432-436	144-148
Less Case $49	432-436	50-54
Wired $75	439.25	61.25

SCANNER CONVERTERS Copy 72-76, 135-144, 240-270, 400-420, or 806-894 MHz bands on any scanner. Wired/tested Only $88.

TRANSMIT CONVERTERS

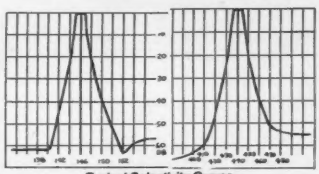
For SSB, CW, ATV, FM, etc. Why pay big bucks for a multi mode rig for each band? Can be linked with receive converters for transceive. 2 Watts output vhf, 1 Watt uhf.

	Exciter Input Range	Antenna Output
For VHF,	28-30	144-146
Model XV2	28-29	145-146
Kit $79	28-30	50-52
Wired $149	27-27.4	144-144.4
(Specify band)	28-30	220-222*
	50-54	220-224
	144-146	50-52
	50-54	144-148
	144-146	28-30
For UHF,	28-30	432-434
Model XV4	28-30	435-437
Kit $99	50-54	432-436
Wired $169	61.25	439.25
	144-148	432-436*

*Add $20 for 2M input

VHF & UHF LINEAR AMPLIFIERS. Use with above. Power levels from 10 to 45 Watts. Several models, kits from $78.

LOOK AT THESE ATTRACTIVE CURVES!



Typical Selectivity Curves of Receivers and Helical Resonators.

SAVE A BUNDLE ON VHF FM TRANSCEIVERS!

FM-5 PC Board Kit – **ONLY $178** complete with controls, heatsink, etc. 10 Watts, 5 Channels, for 2M or 220 MHz.

Cabinet Kit, complete with speaker, knobs, connectors, hardware. Only $60.

REPEAT OF A SELLOUT!

While supply lasts, get $60 cabinet kit free when you buy an FM-5 Transceiver kit. Where else can you get a complete transceiver for only $178

IMPORTANT REASONS WHY YOU SHOULD BUY FROM THE VALUE LEADER:

1. *Largest selection of vhf and uhf kits in the world.*
2. *Exceptional quality and low prices due to large volume.*
3. *Fast delivery; most kits shipped same day.*
4. *Complete, professional instruction manuals.*
5. *Prompt factory service available and free phone consultation.*
6. *In business 21 years.*
7. *Sell more repeater modules than all other mfrs. and have for years. Can give quality features for much lower cost.*

- **Call or Write for FREE CATALOG**
- (Send $1.00 or 4 IRC's for overseas mailing)
- Order by phone or mail ● Add $3 S & H per order
(Electronic answering service evenings & weekends)
Use VISA, MASTERCARD, Check, or UPS COD.

hamtronics, inc.

65-A MOUL RD. ● HILTON NY 14468
Phone: 716-392-9430
Hamtronics® is a registered trademark

See List of Advertisers on page 130

RAMSEY

THE FIRST NAME IN ELECTRONIC TEST GEAR

NEW FROM RAMSEY 20 MHz DUAL TRACE OSCILLOSCOPE

Unsurpassed quality at an unbeatable price, the Ramsey oscilloscope compares to others costing hundreds more. Features include a component testing circuit that will allow you to easily test resistors, capacitors, digital circuits and diodes • TV video sync filter • wide bandwidth & high sensitivity • internal graticule • high quality rectangular CRT • front panel trace rotator • Z axis • high sensitivity x-y mode • very low power consumption • regulated power supply • built-in calibrator • rock solid triggering • high quality hook-on probes

$399.95 high quality hook-on probes included

RAMSEY D-1100 VOM-MULTITESTER

Compact and reliable, designed to service a wide variety of equipment. Features include • mirror back scale • double-jeweled precision moving coil • double overload protection • an ideal low cost unit for the beginner or as a spare back-up unit.

$19.95

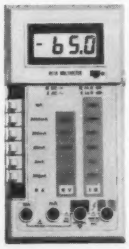
test leads and battery included

RAMSEY D-2100 DIGITAL MULTITESTER

A compact easy to use unit designed to operate like a pro. Featuring • 3½ digit LCD • low BAT. indicator • all range overload protection • overrange indication • auto-polarity •Transistor tester • dual-slope integration • vinyl carrying case

$54.95

h_{FE} test leads, battery & vinyl carrying case included



RAMSEY D-3100 DIGITAL MULTIMETER

Reliable, accurate digital measurements at an amazingly low cost • In-line color coded push buttons, speeds range selection • abs plastic tilt stand • recessed input jacks • overload protection on all ranges • 3½ digit LCD display with auto zero, auto polarity & low BAT. indicator

$59.95

test leads and battery included

CT-70 7 DIGIT 525 MHz COUNTER

Lab quality at a breakthrough price. Features • 3 frequency ranges each with pre amp • dual selectable gate times • gate activity indicator • 50mV @ 150 MHz typical sensitivity • wide frequency range • 1 ppm accuracy

$119.95

wired includes AC adapter

CT-70 kit $99.95
BP-4 nicad pack 8.95

CT-90 9 DIGIT 600 MHz COUNTER

The most versatile for less than $300. Features 3 selectable gate times • 9 digits • gate indicator • display hold • 25mV @ 150 MHz typical sensitivity • 10 MHz timebase for WWV calibration • 1 ppm accuracy

$149.95

wired includes AC adapter

CT-90 kit $129.95
OV-1 0.1 PPM over timebase. . . $59.95
BP-4 nicad pack 8.95

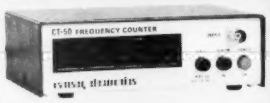
CT-125 9 DIGIT 1.2 GHz COUNTER

A 9 digit counter that will outperform units costing hundreds more. • gate indicator • 24mV @ 150 MHz typical sensitivity • 9 digit display • 1 ppm accuracy • display hold • dual inputs with preamps

$169.95

wired includes AC adapter

CT-125 kit $149.95
BP-4 nicad pack 8.95



CT-50 8 DIGIT 600 MHz COUNTER

A versatile lab bench counter with optional receive frequency adapter, which turns the CT-50 into a digital readout for most any receiver • 25 mV @ 150 MHz typical sensitivity • 8 digit display • 1 ppm accuracy

$169.95

wired

CT-50 kit $139.95
RA-1 receiver adapter kit 14.95

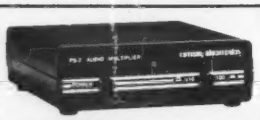
DM-700 DIGITAL MULTIMETER

Professional quality at a hobbyist price. Features include 26 different ranges and 5 functions • 3½ digit, ½ inch LED display • automatic decimal placement • automatic polarity

$119.95

wired includes AC adapter

DM-700 kit $99.95
MP-1 probe set 4.95



PS-2 AUDIO MULTIPLIER

The PS-2 is handy for high resolution audio resolution measurements, multiplies UP in frequency • great for PL tone measurements • multiplies by 10 or 100 • 0.01Hz resolution & built-in signal preamp/conditioner

$49.95

wired includes AC adapter

PS-2 kit $39.95

PR-2 COUNTER PREAMP

The PR-2 is ideal for measuring weak signals from 10 to 1,000 MHz • flat 25 db gain • BNC connectors • great for sniffing RF • ideal receiver/TV preamp

$44.95

wired includes AC adapter

PR-2 kit $34.95

PS-1B 600 MHz PRESCALER

Extends the range of your present counter to 600 MHz • 2 stage preamp • divide by 10 circuitry • sensitivity: 25mV @ 150 MHz • BNC connectors • drives any counter

$59.95

wired includes AC adapter

PS-1B kit $49.95

ACCESSORIES FOR RAMSEY COUNTERS

Telescopic whip antenna—BNC plug	$ 8.95
High impedance probe, light loading	16.95
Low pass probe, audio use	16.95
Direct probe, general purpose use	13.95
Tilt bail, for CT-70, 90, 125	3.95

master charge · BANKAMERICARD · VISA

PHONE ORDERS CALL
716-586-3950
TELEX 466735 RAMSEY CI

TERMS: • satisfaction guaranteed • examine for 10 days; if not pleased return in original form for refund • add 6% for shipping and insurance to a maximum of $10.00 • overseas add 15% for surface mail • COD add $2.50 • orders under $10.00 add $1.50 • NY residents add 7% sales tax • all kits have a 90 day parts warranty. Wired units have a one year parts & labor warranty.

RAMSEY

RAMSEY ELECTRONICS, INC.
2575 Baird Rd.
Penfield, N.Y. 14526

PROPAGATION

J. H. Nelson
4 Plymouth Dr.
Whiting NJ 08759

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	7	7	3A	3A	3A	3A	3A	14	21	21A	21
ARGENTINA	14	7	7B	7B	7	7	14A	21	21A	21A	21A	21
AUSTRALIA	21	14B	7B	7B	7B	7B	7B	14B	14	21	21A	21A
CANAL ZONE	14	7	7	7	7	7	14	21	21A	21A	21A	14A
ENGLAND	7	7	3A	3A	7	7B	14	21A	21A	14	7	7
HAWAII	21	14	7	7	7	7	7	7B	14	21A	21A	21A
INDIA	7	7B	7B	7B	7B	7B	14	14A	14B	14B	14B	7B
JAPAN	14A	7B	7B	7B	7	7	7	7B	7B	7B	7B	14A
MEXICO	14A	7A	7	7	7	7	7A	14A	21A	21A	21A	21
PHILIPPINES	14	7B	7B	7B	7B	7B	7B	14B	14B	14B	14B	14
PUERTO RICO	14	7	7	7	7	7	14	21	21A	21A	21	21
SOUTH AFRICA	14	7	7	7	7B	14	21	21A	21A	21A	21	14A
U. S. S. R.	7	7	3A	3A	7	7B	14	21A	14	7B	7B	7
WEST COAST	14A	14	7	7	7	7	7	14	21A	21A	21A	21

CENTRAL UNITED STATES TO:

ALASKA	14A	7	7	3A	3A	3A	3A	3A	14	21	21A	21A
ARGENTINA	14A	7	7B	7B	7	7	14	21	21A	21A	21A	21
AUSTRALIA	21A	14	7B	7B	7B	7B	7B	7B	14	21	21A	21A
CANAL ZONE	14A	7A	7	7	7	7	14	21	21A	21A	21A	21
ENGLAND	7	7	3A	3A	7	7B	14B	21	21A	14	7B	7B
HAWAII	21A	14	7	7	7	7	7	7	14	21A	21A	21A
INDIA	14	7B	7B	7B	7B	7B	7B	14B	14B	14B	14B	7B
JAPAN	21	14B	7B	7B	7	7	7	7	7B	7B	14B	21
MEXICO	14	7A	7	7	7	7	7	14	21	21A	21A	21
PHILIPPINES	21	14B	7B	7B	7B	7B	7	7	14B	14B	14B	14A
PUERTO RICO	14	7	7	7	7	7	14	21	21A	21A	21A	21
SOUTH AFRICA	14A	7	7	7	7B	7B	14	21	21A	21A	21	14A
U. S. S. R.	7B	7	3A	3A	7	7B	7B	14	14	7B	7B	7B

WESTERN UNITED STATES TO:

ALASKA	14A	7A	7	3A	3A	3A	3A	3A	7	14	21	21A
ARGENTINA	21	14	7B	7B	7	7	7B	14A	21A	21A	21A	21A
AUSTRALIA	21A	21	14	14	7B	7B	7B	7B	14	21	21A	21A
CANAL ZONE	21	7A	7	7	7	7	7	14A	21A	21A	21A	21A
ENGLAND	7B	7	3A	3A	7	7B	7B	14B	21A	14	7B	7B
HAWAII	21A	21	14	7	7	7	7	7	14	21A	21A	21A
INDIA	14	14	7B	7B	7B	7B	7B	7B	14B	14B	14B	7B
JAPAN	21A	14A	7B	7B	7	7	7	7	7	7B	14	21A
MEXICO	14A	14	7	7	7	7	7	7A	21	21A	21	21
PHILIPPINES	21A	21	14B	7B	7B	7B	7	7	7	14B	14B	21
PUERTO RICO	14A	14	7	7	7	7	7	14	21A	21A	21A	21A
SOUTH AFRICA	14A	7	7	7	7B	7B	7B	14	21A	21A	21	14A
U. S. S. R.	7B	7	3A	3A	7	7B	7B	7B	14	7B	7B	7B
EAST COAST	14A	14	7	7	7	7	7	14	21A	21A	21A	21

A = Next higher frequency band may also be useful.
B = Difficult circuit this period.

First letter = night waves. Second = day waves.
G = Good, F = Fair, P = Poor. * = Chance of solar flares.
 # = Chance of aurora.

NOTE THAT NIGHT WAVE LETTER NOW COMES FIRST.

DECEMBER

SUN	MON	TUE	WED	THU	FRI	SAT
				1 P/F	2 F/F	3 F/G
4 G/G	5 G/G	6 G/G	7 F/G	8 F/G	9 F/F	10 F/G
11 F/G	12 F/F	13 F/F	14 F/F	15 F/G	16 G/G	17 G/G
18 G/G	19 F/F*	20 P/F*	21 P/F*	22 F/F	23 F/G	24 F/G
25 F/G	26 G/G	27 G/G	28 P/F	29 P/F	30 F/F	31 F/F

DEALER DIRECTORY

Culver City CA

Jun's Electronics, 3919 Sepulveda Blvd., Culver City CA 90230, 390-8003. Trades 463-1886 San Diego, 827-5732 (Reno NV).

Fontana CA

Complete lines ICOM, DenTron, Ten-Tec, Mirage, Cubic, Lunar, over 4000 electronic products for hobbyist, technician, experimenter. Also CB radio, landmobile. **Fontana Electronics, 8628 Sierra Ave., Fontana CA 92335, 822-7710.**

San Jose CA

Bay area's newest Amateur Radio store. New & used Amateur Radio sales & service. We feature Kenwood, ICOM, Azden, Yaesu, Ten-Tec, Santec & many more. **Shaver Radio, Inc., 1378 So. Bascom Ave., San Jose CA 95128, 998-1103.**

New Castle DE

Factory Authorized Dealer! Yaesu, ICOM, Ten-Tec, KDK, Azden, AEA, Kantronics, Santec. Full Line of Accessories. No Sales Tax in Delaware. One mile off I-95. **Delaware Amateur Supply, 71 Meadow Road, New Castle DE 19720, 328-7728.**

Boise, ID

Rocky Mountain area's newest ham dealer. Call RJM first for AEA, Azden, KDK, Ten-Tec, Butternut, Cushcraft, and more! **RJM Electronics, 4202 Overland, Boise, ID 83705. 343-4018.**

Preston ID

Ross WB7BYZ has the Largest Stock of Amateur Gear in the Intermountain West and the Best Prices. Call me for all your ham needs. **Ross Distributing, 78 So. State, Preston ID 83263, 852-0830.**

Ann Arbor MI

See us for products like Ten-Tec, R. L. Drake, Dentron and many more. Open Monday through Saturday, 0830 to 1730. WB8VGR, WB8UXO, WD8OKN and W8RP behind the counter. **Purchase Radio Supply, 327 E. Hoover Ave., Ann Arbor MI 48104, 668-8696.**

Hudson, NH

Look!—Hams, SWLs, and Experimenters: Parts, Books, Gear, Antennas, Towers. Call for quotes. **Polcari's ELECTRONICS CENTER, 61 Lowell Road (Route 3A), Hudson, NH 03051, 883-5005.**

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UPSTATE NEW YORK

KENWOOD, ICOM, TEN-TEC, Belden, Cushcraft, Larsen, Hustler, ARRL, Hy-Gain, B&W, MFJ, Mirage. New and Used equipment. Serving the amateur community since 1942. **Adirondack Electronics, Inc., 1901 Central Avenue, Albany, New York 12205, 456-0203** (One mile West of Northway exit 2W).

Columbus OH

The biggest and best Ham Store in the midwest featuring Kenwood and other quality products with working displays. We sell only the best. Authorized Kenwood Service. **Universal Amateur Radio Inc., 1280 Aida Dr., Reynoldsburg (Columbus) OH 43068, 866-4267.**

Stigler, OK

TI99/4-4A Basic, Extended Basic, Assembly Language Programs. CW Transceive, CW Practice, DX, 1010, WAS, SSTV, Hamkid's Programs. **AC5D Computer Programs, Box 368, Stigler, OK 74462 967-2034.**

Scranton PA

ICOM, Bird, Cushcraft, Beckman, Fluke, Larsen, Hustler, Antenna Specialists, Astron, Avanti, Belden, W2AU/W2VS, AEA, Vibroplex, HamKey, Amphenol, Sony, B&W, Coax-Seal, Cover Craft, J.W. Miller/Diawa, ARRL, Ameco, Shure. **LaRue Electronics, 1112 Grandview St., Scranton PA 18509, 343-2124.**

Mountaintop PA
WILKES-BARRE AREA

VHF/UHF Equipment & Supplies—From HT's to kW Amplifiers, Transverters, VHF/UHF Microwave Linear Amplifiers, GaAsFET Preamps, OSCAR Equipment, Low Noise preamps, Antennas, Power Supplies. From: ICOM, Lunar, Microwave Modules, UHF Units/Parabolic, Mutek, SSB Electronics, ARCOS, Astron, F9FT-Tonna, Tama, KLM, Mirage, Santec, Tokyo Hy-Power. Two stamps for catalog. **The VHF SHOP, Dept. S, RD4, Box 349, Mountaintop PA 18707, 868-6565.**

Dallas TX

IBM PC/Apple aftermarket products; hobbyists' electronics project kits: $50.00 complete modem kit, subscription/satellite TV decoder kits, EPROM programmer/duplicator, popular memory IC testers, data sheets, application notes, and more than 6000 parts in stock. Semiconductors, discretes, video products, tools . . . Please write for your free literature/catalog. **Independent Electronics, 6415-06 Airline Rd., Dallas TX 75205.**

Baltimore/Washington

Avantek transistors, amplifiers, oscillators and LNAs. Coaxial cable and connectors. Blonder Tongue dealer with Microwave laboratory. **Applied Specialties, Inc., 10101G Bacon Drive, Beltsville, Maryland 20705. Wash. 595-5383, Balt. 792-2211. 7:30 a.m. to 6:00 p.m. Monday thru Friday.**

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Your company name and message can contain up to 25 words for as little as $150 yearly (prepaid), or $15 per month (prepaid quarterly). No mention of mail-order business or area code permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the Feb. '84 issue must be in our hands by Dec. 1st. Mail to 73 Magazine, Peterborough NH 03458. ATTN: Nancy Ciampa.

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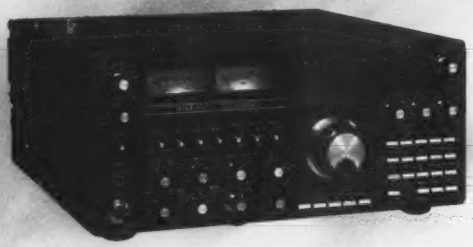
HF FAMILIES

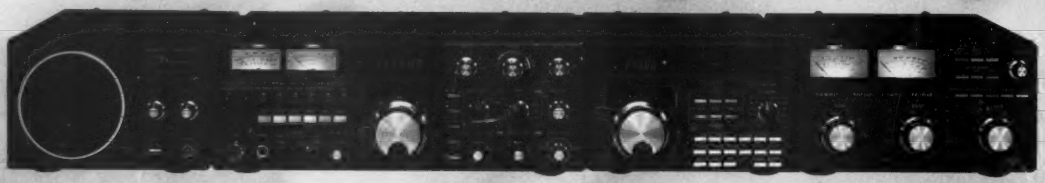


FT-ONE

THE TOP OF THE LINE HF ALL MODE GENERAL COVERAGE TRANSCEIVER WITH COMMERCIAL-GRADE CONSTRUCTION, COMPETITION-GRADE DESIGN WITH UNEQUALLED RECEIVER FILTER PERFORMANCE.
TX: 100W 1.8–29.99 MHz
RX: 150 kHz–29.99 MHz

FT-980 CAT

NEW HF ALL MODE TRANSCEIVER WITH GENERAL COVERAGE RECEIVER, 8-BIT MICROPROCESSOR CONTROL, AND INTRODUCING YAESU'S NEW COMPUTER-AIDED TRANSCEIVER SYSTEM FOR COMPLETE EXTERNAL COMPUTER CONTROL.
TX: 100W 9 bands
RX: 150 kHz–29.99 MHz



FT-102 LINE

Designed for wide dynamic range and clean transmitter output—to give you that extra competitive edge. Three 6146B's give power to spare, while the ultra-modern features give you total operating flexibility and control.

Simple, reliable and thrifty, the all solid-state rig that gives you everything you need for no-frills mobile HF, or base station with the optional FP-700 Power Supply. 100W: 9 bands, SSB and CW, w/FM optional

All mode synthesized general coverage receiver—perfect for serious shortwave listening. Options include 12-channel Memory Unit, VHF Converters, Antenna Tuner and an Active Antenna.

Specifications subject to change without notice or obligation.

V/UHF FAMILIES

FT-208R/708R

Feature-packed FM Handhelds that have proven their superior performance. Microprocessor control assures convenient operation while incorporating every worthwhile feature the serious operator needs.

FT-208R 2.5W/1W RF: 143.5–148.5 MHz

FT-708R 1W/200mW RF: 440–450 MHz

10 memories w/lithium backup
Full scanning features

FT-230R/730R

Compact FM mobiles engineered for reliability and convenience. The perfect balance of current drain and power output for all mobile needs. Built to withstand years of punishing mobile use.

FT-230R 25W RF: 143.5–148.5 MHz
FT-730R 10W RF: 440–450 MHz

FT-290R/690R/790R

All mode portables with full microprocessor control and all of the features needed for serious SSB, CW and FM field operation when powered by eight optional "C" cells. Options also available for mobile and base operation.

FT-690R 2.5/1W RF: 50–54 MHz
FT-290R 2.5W/1W RF: 143.5–148.5 MHz
FT-790R 1W/200 mW RF: 430–440 MHz

FT-480R/680R/780R

All mode base/mobiles with power and performance in all SSB, CW and FM applications. Optional matching FP-80A AC Power Supply makes the perfect base station.

FT-680R 10W RF: 50–54 MHz
FT-480R 10W RF: 143.5–148.5 MHz
FT-780R 10W RF: 430–440 MHz

YAESU

YAESU ELECTRONICS CORP., 6851 Walthall Way, Paramount, CA 90723 • (213) 633-4007
YAESU Cincinnati Service Center, 9070 Gold Park Drive, Hamilton, OH 45011 • (513) 874-3100

Watts to see...

Big LCD, Big 45 W, Big 21 memories, compact.

TR-7950/7930

Outstanding features providing maximum ease of operation include a large, easy-to-read (direct sunlight or dark) LCD display, 21 multi-function memories, automatic offset, programmable priority channel, memory and band scans, built-in lithium battery memory back-up, built-in 16-key autopatch encoder, and a choice of a hefty 45 watts output (TR-7950), or 25 watts output (TR-7930).

TR-7950/TR-7930 FEATURES:

- **NEW, large, easy-to-read LCD digital display**
  Easy to read in direct sunlight or dark (back-lighted). Displays transmit/receive frequencies, memory channel, repeater offset, (+,S,–), sub-tone number (F-0, 1, 2, 3), tone, scan, and memory scan lock-out. Includes LED S/RF bar meter, and LED indicators for REVERSE, CENTER TUNING, PRIORITY, and ON AIR.
- **21 NEW, multi-function memory channels**
  Stores frequency, repeater offset, and optional sub-tone channels. Memories 1 through 15 for simplex or ± 600 kHz offset. Memory pairs 16/17, and 18/19 are paired for non-standard repeater offset. Memories "A" and "B" set upper and lower scan limits, or for simplex or ± 600 kHz offset. In MEMORY mode, a circle of light appears around the memory selector knob. When the memory selector knob is rotated in either direction to channel 1, an audible "beep" will sound.
- **Choice of 45 or 25 watts output**
  The TR-7950 provides a hefty 45 watts output, while the TR-7930 features a more modest 25 watts. A HI/LOW power switch allows power reduction to approx. 5 watts.
- **Long-life lithium battery memory back-up**
  Built-in lithium battery has an estimated 5 year life.
- **Automatic offset**
  The microprocessor is pre-programmed for simplex or ± 600 kHz offset, in accordance with the 2 meter band plan. "OS" key allows manual change in offset.
- **Programmable priority alert**
  The PRIORITY channel may be programmed in any of the 21 memories. With ALERT switch "ON," a dual "beep" sounds when a signal is present on the PRIORITY channel. An OPER switch allows an easy move to the PRIORITY channel.
- **Programmable memory scan lock-out**
  "LO" key for programming scan to skip selected memory channels, without erasing the memory.
- **Programmable band-scan width**
  The lower limit may be programmed into memory "A," and the upper limit into memory "B."
- **Center stop during band-scan, with indicator**
  Stops in center of channel during band-scan, with center tuning indicator.
- **Scan resume selectable**
  Scan stops on busy channel. Selectable automatic time resume-scan (approx. 5 sec., adjustable), or carrier operated resume-scan. A scan delay of approx. 1.5 seconds built-in.
- **Scan control using up/down microphone**
  Momentarily pressing UP or DOWN button on microphone tunes one step in the selected direction, on memory or on 5-kHz step tuning. Holding the button for about 2 seconds starts UP or DOWN automatic scan action. Scan start also possible using "SC" key on keyboard. Scan may be cancelled by momentarily pressing the PTT switch, or by pressing both UP/DOWN buttons simultaneously.
- **Programmable sub-tone channels**
  Optional TU-79 3 frequency sub-tone unit provides keyboard selectable sub-tone channels, which may be stored in memory.
- **Built-in 16-key autopatch, with monitor**
  The keyboard functions as a 16-key autopatch encoder during transmit. DTMF tones appear in the speaker output when a key is pressed during transmit.
- **Front panel keyboard control**
  Used for selecting frequency, offset, programming memories, controlling scan, and autopatch encode. Keyboard lighting is provided.
- **Extended frequency coverage**
  Covers 142.000-148.995 MHz, in 5-kHz steps.
- **Repeater reverse switch**
  Locking-type switch, with indicator.
- **"Beeper" amplified through speaker**
- **Compact, lightweight design**
- **Easy-to-install adjustable-angle mobile mounting bracket**

Optional accessories:

- TU-79 three frequency tone unit.
- KPS-12 fixed-station power supply for TR-7950.
- KPS-7A fixed-station power supply for TR-7930.
- SP-40 compact mobile speaker.

More information on the TR-7950 and TR-7930 is available from all authorized dealers of Trio-Kenwood Communications, 1111 West Walnut Street, Compton, California 90220.

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Specifications and prices are subject to change without notice or obligation.

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